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THE BIRDS OF
WEST-CENTRAL ELLESMERE ISLAND
AND ADJACENT AREAS

By
David F. Parmelee
and
S. D. MacDonald

1960

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PLATE I



July 2, 1955. Incubating Knot near Slidre Fiord. Knots are abundant during nesting in west-central Ellesmere Island. Belonging to the nominate race, they migrate to Old World wintering areas.

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CONTENTS

	PAGE
Introduction.....	1
Acknowledgments	2
Areas of investigation.....	3
Topography.....	5
Climate.....	7
Vegetation.....	11
Faunal investigations.....	11
Eskimo habitations.....	12
Previous ornithological work.....	12
Specimens.....	13
Taxonomy and methods.....	13
Systematic list of birds.....	15
Red-throated Loon.....	15
Brant.....	16
Snow Goose.....	17
Oldsquaw.....	22
King Eider.....	25
Gyr Falcon.....	27
Rock Ptarmigan.....	28
Ringed Plover.....	34
Turnstone.....	34
Knot.....	43
Baird's Sandpiper.....	49
Sanderling.....	51
Red Phalarope.....	53
Long-tailed Jaeger.....	54
Glaucous Gull.....	59
Thayer's Gull.....	62
Arctic Tern.....	64
Snowy Owl.....	67
Common Raven.....	67
Wheatear.....	68
Hornemann's Redpoll.....	69
Lapland Longspur.....	72
Snow Bunting.....	75
Bibliography.....	83

Illustrations

	PAGE
Plate I. Incubating Knot near Slidre Fiord.....	<i>Frontispiece</i>
II. A. Slidre Fiord. Looking west toward Hare Cape and Axel Heiberg Island.....	87
B. Eureka Weather Station at Slidre Fiord.....	87
III. A. Incubating Red-throated Loon at a sedgy pond near Iceberg Point.....	89
B. Young Greater Snow Goose in Axel Heiberg Island.....	89
IV. A. Greater Snow Goose nesting habitat, south of Iceberg Point.....	91
B. Nest of Greater Snow Goose, south of Iceberg Point.....	91
V. A. Arctic desert south of Slidre Fiord.....	93
B. Nesting ledge of Gyrfalcons, south of Slidre Fiord.....	93
VI. A. Male and female Rock Ptarmigans in changing plumage near Slidre Fiord.....	95
B. Female Rock Ptarmigan on nest.....	95
VII. A. Turnstone nesting habitat near Slidre Fiord.....	97
B. Nest of Turnstone near Eastwind Lake.....	97
VIII. A. Female Turnstone on nest in well-vegetated tundra near Eastwind Lake.....	99
B. Incubating Sanderling in clump of <i>Dryas</i> near Eastwind Lake....	99
IX. A. Muddy tundra: the nesting habitat of the Knot, north of Slidre Fiord.....	101
B. Nest 1 of the Knot, north of Slidre Fiord.....	101
X. A. Thayer's Gulls at Slidre Fiord.....	103
B. Incubating Arctic Tern at Slidre Fiord.....	103
Figure 1. Map of northeastern Canadian Arctic Archipelago.....	3
2. Map of western Fosheim Peninsula.....	6

THE BIRDS OF WEST-CENTRAL ELLESMERE ISLAND AND ADJACENT AREAS

INTRODUCTION

The purpose of this investigation was to obtain information on the breeding cycle of birds in the far north. Ellesmere Island, in the Canadian Arctic Archipelago, was attractive because of its high latitude—the more so since weather-stations on its north and west coasts were regularly serviced by military airlift. The west coast, close to Axel Heiberg Island, promised to be the most productive. Particular attention was given to previous records for Ellesmere and Axel Heiberg islands and also to Greenland records.

Twenty-three species of birds were recorded in west-central Ellesmere Island and in parts of Axel Heiberg Island in 1955. Twenty species had been recorded previously. Noteworthy is the fact that not a single alcid from the Eureka Sound – Nansen Sound region has been reported, nor even a Common Eider (*Somateria mollissima*) identified there with certainty. The Purple Sandpiper (*Erolia maritima*), found nesting at 76°N. in King Oscar Land by the Second *Fram* Expedition (Schaanning, 1933), the Parasitic Jaeger (*Stercorarius parasiticus*), found nesting at 82°N. in eastern Grant Land by MacMillan (1918), and the Ivory Gull (*Pagophila eburnea*), found nesting at 79°N. near Cape Hayes, Grinnell Land, by Feilden (1877), were not seen by the authors. The authors also failed to note the following species that have been seen in other parts of Ellesmere Island: Fulmar (*Fulmarus glacialis*), reported by Feilden (1877) and Bay (in Sverdrup, 1904); Gray Sea Eagle (*Haliaeetus albicilla*) and Golden Plover (*Pluvialis dominica*), reported by Greely (1886); Black-bellied Plover (*Squatarola squatarola*), reported by MacDonald (1953); Iceland Gull (*Larus glaucoides*), reported by Greely (1886); Sabine's Gull (*Xema sabini*), reported by Greely (1886) and MacMillan (1918); and the Kittiwake (*Rissa tridactyla*), reported by Greely (1886) and Bay (in Sverdrup, 1904). Of the alcids, the Murre (*Uria lomvia*), the Dovekie (*Plautus alle*), and the Black Guillemot (*Cepphus grylle*) have been reported from Ellesmere Island by a number of observers.

Of the 23 species recorded in west-central Ellesmere Island, the nests of 15 have been found there. The finding of small young and adults with brood patches indicates that at least five more species nest there. The breeding status of the remaining three species is uncertain.

Among these 23 species there are both aquatic and terrestrial forms, both large and small forms, both highly migratory and comparatively non-migratory forms, forms that build elaborate nests and forms that build no nests at all, forms with altricial young and forms with precocial young, forms with short incubation and fledging periods, and forms with long incubation and fledging periods. The significant fact is that all these species are, despite the differences just mentioned, reproductively successful in one of the coldest and driest regions of the world. They survive, despite their failure in some summers to breed at all. Varying as they do in migration and in food and breeding habits, they neither arrive simultaneously, in one great throng, nor depart in that way.

Except for early moulting observed in some species, the authors found little evidence that selection has been at work among these birds in bringing

about a shorter breeding cycle by way of accommodation to shortness of summer. In normal years the summer is of sufficient duration. The land areas of west-central Ellesmere Island and northern Axel Heiberg Island are favourable to bird life, but the seas enclosing these regions support few birds.

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Dr. Ernest Frederick Roots of the Geological Survey of Canada made it possible for us to visit the little explored northern part of Axel Heiberg Island and the east coast of Nansen Sound. Mr. R. Thorsteinsson, also of the Geological Survey of Canada, who noted the activities of geese on the west coast of Axel Heiberg Island in August of 1955, turned his notes over to us. Messrs. V. W. Sim, of the Geographical Branch of the Department of Mines and Technical Surveys, and M. Marsden, of the Arctic Institute of North America, who made observations of the wildlife on the Fosheim Peninsula and Canyon Fiord regions of Ellesmere Island in 1955, also kindly turned their bird notes over to us. Mr. Paul F. Bruggemann, Editor of *Arctic*, and Dr. Charles O. Handley, Jr., of the National Museum, Washington, D.C., let us use their notes and manuscripts on the birds of the Fosheim Peninsula. Dr. Kenneth C. Parkes of the Carnegie Museum, Pittsburgh, loaned us specimens.

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AREAS OF INVESTIGATION

The principal area of investigation was the Fosheim Peninsula, a 2,000-square-mile area of mountains and tundra plain lying north of the 79th parallel. To the west, beyond Eureka Sound, lay Axel Heiberg Island. To the north lay Greely Fiord, to the east Canyon Fiord. About 600 square miles of the peninsula was visited, but the most intensive study was carried on in an 80-square-mile area just north of Slidre Fiord, a 16-mile-long indentation of the west coast.



FIGURE 1. Map of northeastern Canadian Arctic Archipelago (based on maps by National Geographical Society, Washington, D.C.).

Base camp was the joint Canadian-U.S. Weather Station of Eureka ($80^{\circ}00'00''\text{N.}$, $85^{\circ}56'25''\text{W.}$) on the north shore of Slidre Fiord. Ten miles northeast of Eureka the authors established another camp near Eastwind Lake.

From the time of arrival, April 16, 1955, until late May, the authors travelled extensively, northward nearly to Greely Fiord, southward to Blue Man Cape, and southeastward to points 15 to 20 miles from the head of Slidre Fiord. In late May and throughout most of June they worked within 5 miles of the north shore of Slidre Fiord. From late June to mid-July, with their base at Eastwind Lake, they reached several northern parts of the peninsula, including Iceberg Point, the northwesternmost extremity. From mid-July to mid-August they concentrated on Slidre Fiord, travelling up and down both coasts as ice permitted. An attempt to reach Iceberg Point by boat on August 11 was blocked by ice in Eureka Sound. In late August they visited points 5 and 6 miles south of the Fiord. In September they visited the Eastwind Lake area twice—for several days early in the month, again from the 18th to the 23rd. The authors left Ellesmere Island September 27, 1955.

VISITS TO REGIONS OTHER THAN FOSHEIM PENINSULA

During May and July of 1955, the authors accompanied a Canadian geological expedition to several regions west and north of the Fosheim Peninsula. These trips were first undertaken by ski-equipped aircraft and later by land-based helicopters. From one to six hours were spent at each of the following places:

- May 13-14 Strand Fiord, west coast, and Mökka Fiord, east coast, Axel Heiberg Island;
- July 23 $80^{\circ}42'40''\text{N.}$, $90^{\circ}59'\text{W.}$, 18 miles northwest mouth of Stang Bay, east coast Axel Heiberg Island;
- July 24 $80^{\circ}46'\text{N.}$, $88^{\circ}23'40''\text{W.}$, 18 miles southeast of Otto Fiord, northeast coast Nansen Sound, Ellesmere Island;
- July 24 $80^{\circ}57'\text{N.}$, $88^{\circ}44'\text{W.}$, south shore Otto Fiord, Ellesmere Island;
- July 25 $81^{\circ}18'40''\text{N.}$, $92^{\circ}40'\text{W.}$, 8 miles southeast Cape Stallworthy, north coast Axel Heiberg Island;
- July 25 $80^{\circ}20'\text{N.}$, $89^{\circ}16'\text{W.}$, 5 miles west Flat Sound, east coast Axel Heiberg Island;
- July 25 $80^{\circ}12'\text{N.}$, $87^{\circ}54'\text{W.}$, 3 miles northeast Isthmus of Schei Peninsula, east coast Axel Heiberg Island;
- July 26-27 Mökka Fiord.

Ornithologically, the most significant result of these trips was the failure to find gull and alcid colonies from the west end of Greely Fiord northward on both sides of Nansen Sound nearly to Cape Stallworthy on the Polar Sea. From a helicopter the authors had an excellent view of magnificent cliffs that towered precipitously 2,000 feet or more above the sea. The absence of sea birds is attributed to the closed sea. Shore leads at that late date were narrow, and in most cliff areas ice locked the shore. Other significant finds were as follows: many large flocks of

Greater Snow Geese (*Chen hyperborea atlantica*) and a Baird's Sandpiper (*Erolia bairdii*) in Axel Heiberg Island; a breeding colony of Ringed Plovers (*Charadrius hiaticula*) southeast of Otto Fiord.

In addition to the above, V. Sim and M. Marsden noted the wildlife of the Caledonian Bay area of Canyon Fiord east of the Fosheim Peninsula, July 23-27, 1955, and R. Thorsteinsson recorded the activities of geese on the west coast of Axel Heiberg Island, August 1-18, 1955.

TOPOGRAPHY

In westernmost Fosheim Peninsula the land gradually rises from sea-level in the north to a bold coastal ridge whose highest summits reach about 2,000 feet. The ridge is divided by Slidre Fiord, the part to the north being called Northwest Ridge, the part to the south Harecape Ridge. The north end of Harecape Ridge, Hare Cape itself, is a bold and important landmark. The south end is much lower, the two summits there each reaching about 1,000 feet.

Although its entrance is dominated by high land, Slidre Fiord is surrounded largely by low, thick, sedimentary deposits which contain little rock except where sandstone outcrops along ridges and in gullies. Gravel is fairly extensive in delta areas, but scarce elsewhere. The fiord slopes are frost-heaved, cracked, and deeply gullied. The fiord itself is deep and averages 2 to 3 miles in width.

North of Slidre Fiord, between Northwest Ridge on the west, Greely Fiord on the north, and Black Top Ridge (3,000 feet) on the east, lies a plain whose drainage is so good that there is only one notable body of water in it—Eastwind Lake (526 feet elevation). This lake, one of the largest on the peninsula, is $1\frac{1}{8}$ miles long and less than half a mile wide. It is fed by a creek from Black Top Ridge, and its outlet flows northward. Just south of the lake is a network of marshy ponds. South of there the plain is drained by two major streams, Black Top Creek and Station Creek, which flow into Slidre Fiord. Eureka is near the delta of Station Creek. North of Eastwind Lake the plain is drained by several streams which flow into Greely Fiord.

Iceberg Point in northwestern Fosheim Peninsula was named Isfjeldodden by Fosheim (in Sverdrup, 1904, 2:205). The land there is low, and a cluster of lakes lies near the point. Five miles east of the point is Mt. Lockwood (1,300 feet). Ten miles farther east a horseshoe-shaped hill (1,000 feet) cradles a large lake. From this hill eastward, a low plain extends all the way to Canyon Fiord.

This same plain extends southward far east of Black Top Ridge to mountainous country. Slidre River flows westward through it, becomes braided, and enters Slidre Fiord. The lower valley and adjacent flats of this stream are peculiar in that the ground is covered with loose sand and silt. Dust storms occur during dry and windy weather. Drainage is often sluggish in northeastern Fosheim Peninsula where lakes, ponds, and marshes are fairly numerous.

Parallel to Canyon Fiord is a coastal range which at Cape With, a point due east of Slidre Fiord, attains an elevation of 2,000 feet. Here is the only sheer sea cliff of the peninsula. South of Cape With, rugged glaciated

mountains cross the peninsula in a northeasterly-southwesterly direction. The usually dark, 4,000-foot peaks, separated by broad shimmering valleys of ice, are clearly visible at Eureka, 40 to 50 miles away. The apt name "Sawtooth Range" has been given to them. Fosheim's (in Sverdrup, 1904, 2:281) famous "Wolf Valley" runs from the head of Canyon Fiord into this range. Fosheim attempted to cross the peninsula following the valley, but a mountain blocked his way.

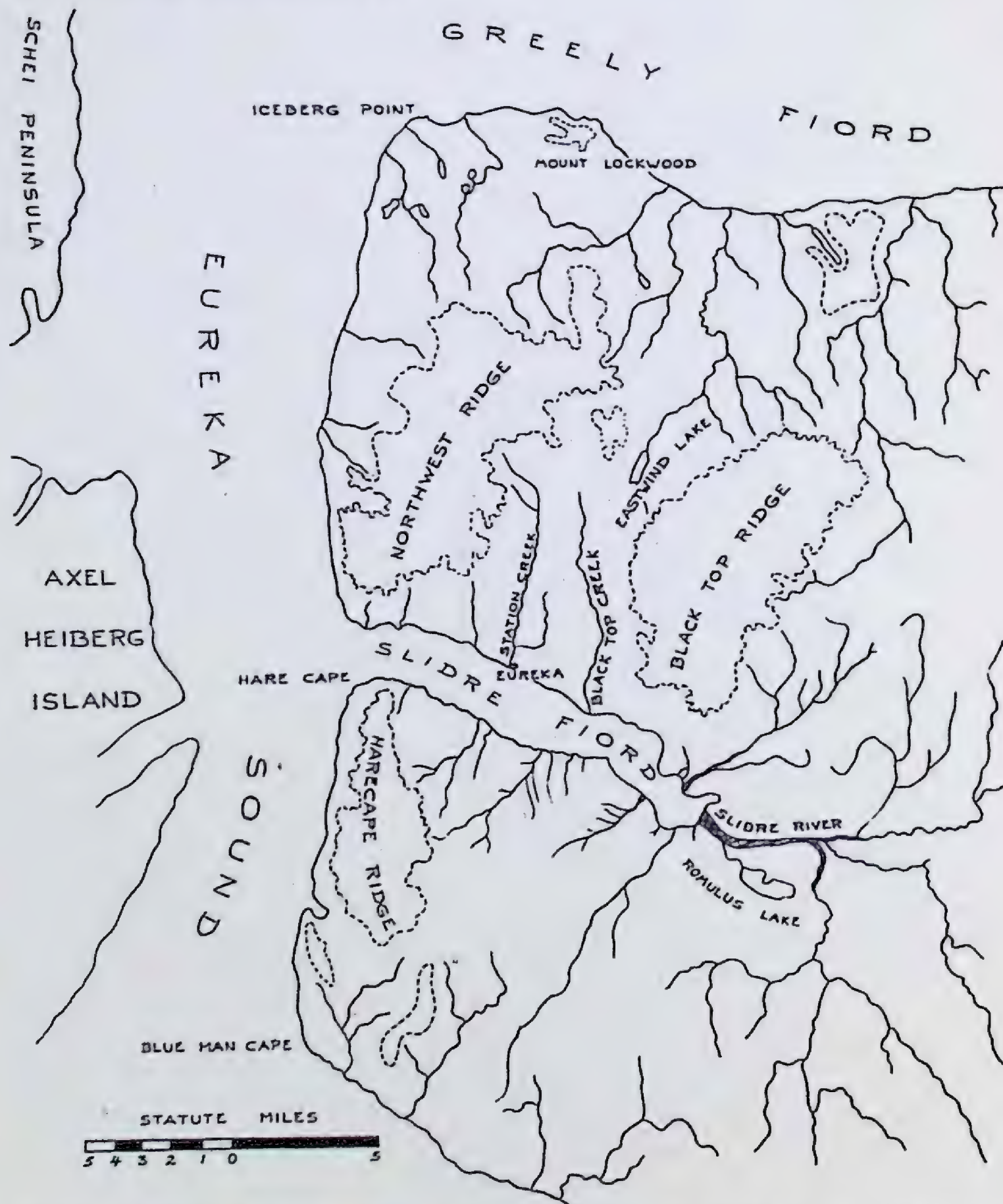


FIGURE 2. Map of western Fosheim Peninsula (based on maps by the Geographical Branch of the Department of Mines and Technical Surveys, Ottawa). The 80th parallel lies close to Eureka on the north shore of Slidre Fiord.

South of Slidre Fiord there are comparatively few lakes. The plain that extends from Harecape Ridge eastward and southward becomes a plateau west of the Sawtooth Range. Conspicuous are the outcrops of bed-rock sandstone, which become noticeable near Slidre Fiord where streams have cut outlets through them. Six miles east of Harecape Ridge, along the south shore of the fiord, a narrow sandstone scarp with vertical west front runs southwestwardly. It is highly weathered, attains a height of 750 feet, and unofficially is called "Sandstone Ridge." Several miles inland it abruptly disappears. Where it reappears, it resembles a medieval fortress with sheer walls 100 feet high. Wind has cut bizarre formations and pinnacles on both sides. Slopes of sand give access to the top. Here the sand is deep and pure and without plants. Gyrfalcons (*Falco rusticolus*) resided here in 1955 and probably have done so for many years.

Black Top Ridge is a mountain of "intrusive rocks of dolerite overlapping sandstone" (Tener, 1954). Rising above the tundra plain, it is 12 miles long and the dominant mountain of the Slidre Fiord area. Its bold west front is unclimbable except near its middle, where it is nearly severed by a large stream-cut gorge. Its lower end gradually descends, by a series of bluffs, to sea-level at the head of Slidre Fiord. Through this bluff country, the waters have cut a deep gorge in which gulls nest. Frost has everywhere shattered the surface of this mountain into sharp angular pieces that cover whole slopes and ridge tops. Above great banks of scree hang precipitous cliffs. It is these cliffs, dark and prodigious, that give the mountain its name.

During Pleistocene time, according to Troelsen (1952), the region had a continuous ice-cover, whose centre was probably in eastern Ellesmere Island. As the ice receded, the sea advanced across the low plain of the Fosheim Peninsula, falling back as the land rose. Shells are conspicuous on the surface of this raised sea-bottom. The highest marine beach measured by Troelsen at Slidre Fiord was 465 feet above sea-level.

Although Schei (in Sverdrup, 1904, 2:460) reported Mesozoic formations along both coasts of Eureka Sound, Troelsen (1952:208) states that the only Mesozoic deposit known with certainty from Ellesmere Island previous to 1952 was the Triassic Blue Mountain formation. In 1952 Troelsen found additional Mesozoic formations on the plains around Slidre Fiord and in northeastern Fosheim Peninsula, a notable item being the remains of a plesiosaurus in shale about two miles from Eureka. In 1955 a petrified tree trunk, supposedly Cretaceous, was found on the plain east of Slidre Fiord. Strata with coal beds, apparently Cenozoic, lie exposed on the peninsula.

CLIMATE

Latitude. On the Fosheim Peninsula, continuous darkness lasts from about October 22 to February 20, and continuous daylight from about April 14 to August 31. During constant daylight the sun dips toward the northern horizon every 24 hours. When the sky is clear, the light is never too poor at that time for photography, although light intensity is low in the deeper gullies and on shady slopes between 9.00 p.m. and 1.00 a.m.

Topography. The Fosheim Peninsula is surrounded by high, ice-covered mountains which influence the climate. As illustrated by Baird (1955:97), the ice-caps of Grant Land lie to the north; those of Grinnell to the east, of Ellesmere to the southeast, of North Lincoln to the south, and of Axel Heiberg Island to the west. The land masses of Grant Land and Axel Heiberg Island modify climatic influences of the Polar Sea. The lesser mountains and ridges of the peninsula also influence the climate profoundly. That their influence is protective is readily perceptible when the land lying about them is compared with that of the northwest part of the peninsula. Here cold winds from the polar pack sweep down Nansen Sound, rushing over Iceberg Point and the plains to the southeast, creating a desolate lowland.

According to Rae (1951) the high mountains in Eastern Ellesmere Island act as a mechanical barrier, preventing the free transport of air from one side to the other. That this is significant can be seen by comparing temperatures and precipitations of the Fosheim and Bache peninsulas, located at about equal latitudes on opposite sides of the range, the mean annual temperature and total annual precipitation for the former (Eureka) being -4°F. and 1.74 inches respectively, for the latter, $+4^{\circ}\text{F.}$ and 5.19 inches.

Air temperature. Annual range in mean temperature at Eureka has been 84°F. , one of the greatest for the Archipelago. An extreme low of -63°F. and extreme high of 66°F. have been recorded.

Temperatures (Fahrenheit) recorded at Eureka in 1955:

	April	May	June	July	Aug.	Sept.
Mean max. temp.....	-8.6	16.2	36.6	42.4	42.8	23.7
Mean min. temp.....	-22.5	1.7	31.8	35.2	34.6	16.1
Monthly mean.....	-15.5	8.9	34.2	38.8	38.7	19.9
Highest temp.....	18.9	32.9	42.7	48.8	55.8	35.8
Lowest temp.....	-43.8	-19.1	21.1	31.1	26.3	-1.8

Although rising May temperatures hinted of spring, the country remained cold and wintry into June. In this freezing weather there was, however, much evaporation of snow. A peculiar phenomenon noticeable at this time was the grey, sand-covered snow which lay in quantity along lower banks and gullies. This grey snow, particularly on steep south-facing banks, was largely gone before the regular thaw set in. Each sand grain was a heat absorbing unit; together, the grains absorbed enough heat to destroy the snow prematurely. By May 18 whole banks of snow were deeply pitted. Mud formed at the foot of some of them, and here early grass appeared.

The regular thaw began in lower stream-beds near the coast. Water trickled down some of the steeper gully banks on May 27. The following day Eureka recorded its first above-freezing temperature for the year with

a high of 32.9°F. Although the temperature dropped to a high of 24.0°F. on May 29, there were numerous slush pools in the gully beds by the 30th. Above these lower coastal places there was no significant thaw, and the upper slopes were white with hard snow even as late as June 4. Most of the land birds had arrived by this time.

By June 6 the thaw began in earnest. Eureka had an unexpected high of 40.2°F., and the country was transformed from winter into spring in what seemed to be a single day. Rivers of slush crept down the dry stream-beds, spilling over the ice of the fiord. The fast waters of the streams could hardly be forded the following day, and lakes formed on the sea-ice beyond the deltas. Where the rushing fresh waters cut through the ice, a dangerous whirlpool formed. Within the week the truly aquatic birds arrived.

Temperatures did not again reach 40°F. until June 18, but much of the snow was gone, and ill-defined leads had formed along the coast by that time. Tidal action at Slidre Fiord is slight, extremes of high and low tide being less than two feet. Apparently this is enough to form leads. Some inland lakes accommodated water birds as early as June 14.

There was no snow on level ground by July. The shore leads of Slidre Fiord were wide by mid-July, and boating up and down the coast was possible. The main body of ice commenced breaking at the head of the fiord, and by late July it was breaking everywhere. By August it was broken and pushed about by wind and water currents. Snow fell several times during the summer. All hills over a thousand feet high were white with new snow July 28. Temperatures topped 50°F. twice at Eureka—50.6°F. and 55.8°F. on August 5 and 7, respectively.

All fresh waters froze over solid September 4 to 5. Slidre Fiord remained open nearly two weeks longer. New ice along the shore stopped dredging activities after September 11. What remained of the old ice, including the incredible bergs that occasionally drifted in and out of the fiord, was caught by new ice that sometimes reaches a depth of 8 feet. Much of this frozen sea was thus rough and hummocky. From the hills north of Eureka no open water could be detected on the fiord September 17, but water clouds hung low over Eureka Sound.

Precipitation. The Fosheim Peninsula is one of the driest regions in the world. The extreme dryness is not apparent to the casual observer, for the snow that collects on the lea of slopes and in depressions is often thick. Snowbanks 100 feet high and slopes waist-deep in snow were not exceptional, giving the impression of heavy snowfall. But everywhere there was exposed ground, and nowhere did the authors find areas that were difficult to cross on foot. Even much of the drifted snow was hard. With the coming of the thaw and cloudy weather, the country appeared anything but dry. From the second week of June to early July, mud was everywhere, except on the gravel banks and rocky ridges, but a thin crust soon dried and walking became easier. In August the streams were reduced to mere creeks, being fed by the last snows of the high interior. Most areas, however, still did not look like desert. The high relative humidity, fog, and drizzling rain abetted this illusion. Only after the September freeze-up did the land take on the dreary, dry, monotonous appearance of desert. Even then stormy weather made the dry land seem wet.

The dryness of the Fosheim Peninsula (recorded at Eureka) in 1955 is best shown below:

	April	May	June	July	Aug.	Sept.
Rainfall (inches).....	0.0	0.0	0.22	0.26	0.07	trace
Snowfall (inches).....	0.8	0.2	0.08	0.2	trace	1.9
Total (inches).....	0.08	0.02	0.3	0.28	0.07	1.9
Number of days of measurable precipitation.....	7.0	2.0	7.0	7.0	3.0	6.0
Depth of snow on last day of month.....	7.0	6.5	0.0	0.0	0.0	1.0

Relative humidity. The average relative humidity of 76 per cent (July) for Eureka is among the lowest recorded for weather stations in the Archipelago. Extremes of relative humidity recorded at Eureka in 1955 are as follows:

Relative humidity (%)	April	May	June	July	Aug.	Sept.
Maximum.....	92	96	100	100	100	96
Minimum.....	68	59	66	48	50	52

Winds. In summer the entire Canadian Arctic Archipelago is in a flat, high pressure area; the pressure gradients are weak and poorly defined, resulting in wind directions governed chiefly by land- and sea-breezes, local topography, and travelling cyclones (Ray, 1951). At Slidre Fiord, in 1955, the prevailing winds in April and May were eastern; in June, northwestern and southeastern; in July, northwestern; in August, northwestern and southeastern; in September, northwestern. Southwest winds were infrequent. The largest number of calm periods occurred in April and May. July was the windiest month, and the greatest wind velocity (40 m.p.h.) occurred April 19 to 20.

Snow crystals in the Archipelago are small and sandlike. According to Ray (1951) these are easily picked up and carried aloft by winds of 15 m.p.h., or more. Visibility is reduced to near zero in winds greater than 40 m.p.h., a fact that was very apparent at Slidre Fiord during a blizzard April 19 to 20, 1955. This sandlike snow blows back and forth across the high arctic throughout the cold months. The sweeping action of the wind, the low precipitation, and the peculiar snow give the high arctic the sharp contrast of deep, compact drifts and snow-free areas.

On May 18 the authors saw tornado-like snow tunnels on the tundra plain west of Black Top Ridge. Some of the funnels rose several hundred feet and were spectacular against the cloudless sky.

VEGETATION

In 1951 Tener (1954) found the plains near Slidre Fiord sparsely vegetated and for the most part covered with gravel, rock, silt, and clay. The most abundant plant, according to Tener, was an avens, *Dryas integrifolia*, although collectively three grasses of the genus *Poa* were more abundant. Willow (*Salix arctica*) was also abundant, followed in order by the sedge *Carex rupestris*, the grass *Alopecurus alpinus*, and the grass *Agropyron latiglume*. Mosses and lichens were uncommon.

The authors also found the vegetation of the Slidre Fiord area and elsewhere on the Fosheim Peninsula to be thin and scattered. Nowhere were the woody plants more than a few centimetres high. Areas that were snow-free in winter had comparatively few plants. Here the surface dried rapidly after the thaw. Areas rich in vegetation almost invariably were snow-covered in winter and remained wet until August. Plant density often attained a maximum at the edge of slowly receding snows. Here arctic heather (*Cassiope tetragona*) grew profusely, darkening the landscape. These so-called "snow patches" were widespread but local.

There was much hummocky tundra on the inland plains, especially on the broad ridges and in areas bordering marsh. Much of this tundra was thinly covered with snow that thawed rapidly. Sheltered places between the hillocks, however, trapped moisture, and the vegetative cover was fairly good. Many birds nested in this habitat.

Marshy ponds upgrown to sedges (*Carex*, *Eriophorum*) were fairly common, but many lakes and ponds were devoid of plant life. In general, vegetation was lush about ponds situated in valleys or depressions. Even on the Iceberg Point barrens, low ponds were sedgy.

The coastal slopes about Slidre Fiord are mostly non-vegetated, and the region has a desolate appearance. To the north the greenest land is near Eastwind Lake. To the south, where there are few lakes, vegetation reaches its greatest density in the old creek beds. The plain east of Black Top Ridge supports considerable vegetation. According to Bruggemann (1953-54), several plants grow here, but probably nowhere else on the peninsula. The high ridges and mountains are mostly barren, though some plants grow at 3,000 feet. On the west front of Black Top Ridge, vegetation is dense along certain creeks but scarce elsewhere.

In the main body of this work the authors discuss the relationships of the more important plants to each species of bird. Since the flora of the Fosheim Peninsula is well known, no attempt is made to list all the plant species that have been seen or collected there. Bruggemann (1953-54) found about a hundred species of vascular plants on the peninsula, including rare *Geum rossii*. Of special interest in this respect, the authors found *Geum rossii* not only on the peninsula but also in Axel Heiberg Island (80°42'40"N., 90°59'W.) on July 23, 1955.

FAUNAL INVESTIGATIONS

In 1955 the authors collected a number of animals other than birds on the Fosheim Peninsula and adjacent waters. These, notably marine invertebrates and mammals, will be reported on at a later date.

With respect to mosquitoes in 1955, they presented no problem. They emerged in late June and reached maximum abundance three to four weeks later, being especially noticeable in eastern Fosheim Peninsula. North of Slidre Fiord they were fairly abundant at Eastwind Lake, but elsewhere they were local. None were seen at Iceberg Point, July 10 to 12. They were last seen on the peninsula on August 22.

The arctic hare (*Lepus arcticus*) was the mammal most frequently seen, being especially common on the higher ridges of the Fosheim Peninsula and in parts of Axel Heiberg Island. Although the largest single group seen numbered only 17, the thousands of tracks leading in one direction suggested mass migration or irruption. The arctic fox (*Alopex lagopus*) was conspicuous at Eureka where it pilfered food scraps. Elsewhere it was common, and it or its tracks were noted nearly everywhere. Another fairly common predator was the arctic wolf (*Canis lupus*). The collared lemming (*Dicrostonyx groenlandicus*) was scarce. In six months the authors saw only four, one of which was a small young one found dead in a nest. The arctic weasel (*Mustela erminea*) was exceedingly rare; the authors noted its tracks only once. The white-faced muskox (*Ovibos moschatus*) was common and conspicuous, whereas Peary's caribou (*Rangifer pearyi*) was rare. Only three caribou were seen on the Fosheim Peninsula, but a herd of 11 was seen on the Schei Peninsula, Axel Heiberg Island, July 25.

On occasion, the authors drove muskoxen from areas containing nests under observation. Herds often remained in an area for several days, and the hoofprints of even a few animals were thickset and deep. Hoofprints of muskoxen were as characteristic of the summer tundra as dryas and willow. The prints remain preserved for years in this desert country.

The marine waters were as poor in mammals as the land was rich. Troelsen (1952) frequently observed seals on the sea-ice of Canyon Fiord, Greely Fiord, and Eureka Sound, but the authors saw few. The only species identified with certainty in 1955 was the ringed seal (*Phoca hispida*). Under the circumstances it is not surprising that no polar bears (*Thalarctos maritimus*) were seen. Tracks of the polar bear were found near Iceberg Point by Fosheim, and Sverdrup found the species fairly abundant farther south in Eureka Sound (Sverdrup, 1904). Notes on the species are recorded in the Eureka files, but these notes are vague.

ESKIMO HABITATIONS

No Eskimos inhabit Ellesmere Island today, except for a few families at the Royal Canadian Mounted Police posts at Alexandra Fiord and Craig Harbour, on the east and south coasts respectively. None of these people are native to the island. They have been brought in from the outside as guides for police patrols. Old Eskimo camp-sites are widely scattered along the coasts, even up through Eureka Sound. One of these is on the north shore of Slidre Fiord east of the delta of Black Top Creek.

PREVIOUS ORNITHOLOGICAL WORK

Since waters along the west coast of Greenland have at times been navigable, several early explorers were able to reach northeastern Ellesmere Island, and the reports concerning their expeditions included some bird

material. The Nares Arctic Expedition visited the north coast in 1875-76. In 1882-84 the United States Expedition to Lady Franklin Bay explored the interior of Grinnell Land and reached Greely Fiord; but the west coast of Ellesmere Island was not explored in its entirety before 1901, when the Norwegian Polar Expedition (Second *Fram* Expedition of 1898-1902) travelled north through Eureka and Nansen sounds, all the way to Lands Lokk, and in so doing nearly encircled the Fosheim Peninsula. Both the Crocker Land Expedition (1913-17) and the Danish Thule-Ellesmere Island Expedition (1939-41) touched on the peninsula. All of these parties, including R.C.M.P. patrols, travelled by sledges. Those that visited the Fosheim Peninsula and adjacent areas did so before the spring thaw and consequently before arrival of most birds. The only mention of birds by Fosheim (in Sverdrup, 1904, 2:275) concerns a few ptarmigan tracks seen near Iceberg Point, May 6, 1901. The birds of this region were practically unknown before the establishment of Eureka at Slidre Fiord in 1947.

Duvall and Handley (1948) noted birds and mammals during brief visits to Slidre Fiord in August of 1947 and 1948. Some bird specimens were secured by them, notably geese and ptarmigan. Hatfield, officer-in-charge at Eureka, later supplied Handley with additional notes on the birds of Slidre Fiord for the years 1948 and 1949. In 1951 Tener (1954) observed the muskox herds in conjunction with certain range studies at Fosheim Peninsula. He collected 35 birds, which already have been reported and discussed by Godfrey (1953). In 1952 Troelsen (1952) studied geology at Canyon Fiord and reported on the wildlife, including birds, of the general region. Bruggemann (1953-54) continued study of the muskoxen at Fosheim Peninsula in 1953 and 1954. He also contributed data on the flora and other fauna, which included much information on birds. The present study takes into account the findings of all these many observers.

SPECIMENS

One hundred and ninety-three bird skins were collected by the authors in 1955. Of these, 173 were collected on the Fosheim Peninsula, Ellesmere Island, three on the northeast coast of Nansen Sound, Ellesmere Island, and 17 in Axel Heiberg Island. Collected, also, were 12 sets of eggs on the Fosheim Peninsula. Of these specimens, 109 skins and two sets of eggs are in the National Museum of Canada; 84 skins are in the Sutton Collection (University of Oklahoma, Norman); 10 sets of eggs are in the Parmelee Collection (Kansas State Teachers College, Emporia).

TAXONOMY AND METHODS

Among the 23 species of birds discussed in the text, seven orders, 13 families, and 22 genera are represented. The genus *Larus* is represented by two species. As to certain shorebird genera, there is a sharp difference of opinion. Most British ornithologists believe that the peeps and their allies, including the Knots, belong in one genus, *Calidris*. Most Canadian and American ornithologists reserve *Calidris* for the Knots only, and place most of the peeps, including Baird's Sandpiper, in *Erolia*. In any event, all 23 birds are distinct forms.

The authors for the most part agree with Godfrey's (1953) handling of the races or subspecies of Ellesmere Island birds, which include those of the west coast. For reasons discussed below, the authors prefer to give Thayer's Gull (*Larus thayeri*) species recognition until its taxonomy is better understood. The authors' handling of Ellesmere Island Rock Ptarmigan (*Lagopus mutus*) particularly, is not satisfactory and demands further collecting and a comparison with Greenland material.

Wing chord, tail, bill, and tarsal measurements were taken with calipers and a millimetre rule. Measurements up to 100 mm were taken to 0.5 mm, above 100 mm to 1.0 mm only. Bill measurements in some cases were taken to 0.1 mm. Flattened wing measurements were taken by straightening and pressing the primaries flat along a millimetre rule so as to obtain the greatest length possible. Measurements were taken for both right and left wings, the greatest length being recorded; tarsal measurements were likewise recorded. Exposed culmen measurements were recorded as the distance from the edge of feathering to tip of bill.

Although it was beyond the scope of this work to compare series of Ellesmere Island specimens with series of specimens from other regions, the authors compared a small series of Fosheim Peninsula Turnstone (*Arenaria interpres*) eggs with Turnstone eggs taken at lower latitudes in the Canadian Arctic Archipelago. Employed in the statistical analysis was Fisher's *t* formula where:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sum X_1^2 + \sum X_2^2 + (\sum X_1)^2 + (\sum X_2)^2}{N_1 + N_2 - 2} \left(\frac{N_1 + N_2}{N_1 \cdot N_2} \right)}}$$

Several terms that are used regularly in the text need clarification. With respect to bird density, the term "common" is here used when a species, apparently, approaches maximum abundance, taking into account the time of residency, size of territory and expected density for the species, proportion of breeding to non-breeding individuals in some cases, habitat niche, and amount of suitable habitat available. In 1955 the authors considered only a few species common to the Fosheim Peninsula and adjacent areas. Other species did not approach maximum abundance and were uncommon; still others were seen so infrequently that they were considered rare. Some species were conspicuous, or locally abundant, but not truly abundant. Collecting and banding helped determine the approximate numbers of certain species at Slidre Fiord.

The term "early May" (or "early June," etc.) here means the first 10 days of the month; the term "mid-May," etc., means the second 10 days of the month; the term "late May," etc., means the last 10 or 11 days of the month. Thus mid-July does not necessarily mean July 15; it means July 11 to 20. These terms do not fit every circumstance, of course. They are convenient in summarizing data.

The authors follow Johansen's (1956) handling of various arctic subdivisions. The Fosheim Peninsula and other regions at high latitudes lie far north of the southern boundary of the Canadian high arctic. The high arctic, in this sense, comprises all regions with a July air temperature mean below 41°F.

SYSTEMATIC LIST OF BIRDS

Gavia stellata (Pontoppidan) Red-throated Loon

The Red-throated Loon has been uncommon on the Fosheim Peninsula. In 1955 it was thinly dispersed and conspicuously absent at many marshy pond areas. No other loon is known to inhabit the region.

On the Schei Peninsula, in Axel Heiberg Island, the authors noted a pair of Red-throated Loons with two downy young near a nest at a marshy pond on July 25, 1955.

Arrival. According to Salomonsen (1950-51) Red-throated Loons return to Greenland breeding areas singly and in full summer plumage, arriving in the high-arctic region in early and mid-June. On the Fosheim Peninsula, the two birds seen by Tener (Godfrey, 1953) at Slidre Fiord on June 16, 1951, were paired. Two seen by Bruggemann (1953-54) at Slidre Fiord on June 19, 1953, possibly were a pair; in 1954 he first noted loons (one pair) on June 26, at a time when they were well established inland.

The species was first noted at Slidre Fiord in 1955 on June 11—a single bird on the flooded sea-ice near Eureka. On June 18 a single individual was in a lead that extended across the fiord. That day Sim and Marsden saw one far inland at a lake 18 miles northeast of the head of Slidre Fiord. They had not seen one there June 14, although the lakes had been partly open and were occupied by other water birds. Courtship displays were observed inland but not at the fiord.

Nesting. Both MacMillan (1918) and MacDonald (1953) found the Red-throated Loon breeding on the north coast of Ellesmere Island. Greely (1886) recorded the species but not a nesting for the east coast. According to Bay (in Sverdrup, 1904) it was not common in southern Ellesmere Island (King Oscar Land) where, according to Schaanning (1933), a clutch of two eggs was collected on July 21, 1901.

Several nests have been found on the Fosheim Peninsula. A nest found in 1951 by Tener (Godfrey, 1953) at a marshy pond south of Eastwind Lake was likely the same one found by Bruggemann (1953-54) in 1954 and by the authors in 1955. This nest was a conspicuous mound of mud and plant debris near the tip of a narrow strip of partly submerged ground that extended far out from shore. Its size alone suggested long use. When first seen by Tener on June 23, there was one egg; by Bruggemann on June 26, two eggs; by the authors on June 28, two eggs. The eggs were not pipped when checked July 15, 1955. On July 30 the nest was empty, but a single young and its parents were in the water close by. In 1954 Bruggemann had a similar experience in finding the nest empty and only one chick thereabout on July 19. Sutton (1932) noted the re-use of Red-throated Loon nests on Southampton Island.

In one of several marshy networks of ponds near Iceberg Point, on July 11, the authors collected an incubating female loon and its two eggs, which were nearly fresh. The nest was an inconspicuous shelf of mud at the edge of a grassy islet 20 feet from shore. Allowing 29 days for incubation (Sutton, 1932), the eggs at this nest would have hatched about August 7.

On July 18 the authors, while flying in a helicopter over marshy tundra 18 miles east of Slidre Fiord, spotted a Red-throated Loon on its nest.

Departure. Autumn migration in high-arctic Greenland takes place from early to mid-September, the fresh waters being deserted altogether in late August (Salomonsen, 1950-51). On the Fosheim Peninsula, the authors did not determine when the loons left the inland waters in 1955. On September 4, Eastwind Lake and adjacent ponds were fast freezing over, and no loons were there. Loons were noted several times at Slidre Fiord in early September, the latest date being September 10 (two birds). By September 15 the fiord was freezing rapidly.

Food. While observing the loons near Eastwind Lake, the authors noted that one of the pair, after change-over at the nest, often flew directly south toward the fiord. Since no ponds were along the flight line, the birds probably went to the fiord where loons were occasionally seen feeding in wide leads along the north shore during July. The largest number seen there at one time was seven (July 18). They were scattered widely along a 6-mile stretch of shore. Red-throated Loons also were noted occasionally on the open waters of Slidre Fiord during August 4 to 29. Flights between the breeding places and the sea have been noted elsewhere (Sutton, 1932; Salomonsen, 1950-51) and are probably characteristic of the species.

The stomach of the female collected near Iceberg Point on July 11 contained fish vertebrae only.

Specimens. The adult female (wing chord 280.0 mm, flattened wing 288.0, exposed culmen 52.0, tarsus 68.0) collected at Fosheim Peninsula July 11, 1955, was not moulting. Its two eggs measured 71.0 by 45.0 mm and 70.0 by 45.5.

Annual breeding cycle. Red-throated Loons appear singly and in twos at Slidre Fiord in mid-June. Inland flights to fresh water commence by June 18, probably earlier. The preferred nesting places are grassy tundra ponds, not large deep lakes nor sterile mountain ponds. Egg-laying takes place from about June 20 to July 10. Both sexes incubate and attend young. Hatching occurs as early as July 19, probably as late as August 7. Adult loons feed in Slidre Fiord all summer. Flightless birds have not been observed at the fiord, and there is no evidence of postnuptial moult taking place there. No loons have been seen at Slidre Fiord after September 10.

***Branta bernicla* (Linnaeus) Brant**

Not all observers, including the authors, have seen Brant on the Fosheim Peninsula. Hatfield (in Handley, unpub. MS.) saw many there in 1948 but none in 1949. In 1951 Tener (Godfrey, 1953) saw 11 Brant "in northerly flight" on June 7. Bruggemann (1953-54) saw none during his extensive travels in 1953-54. Knowing how infrequently this species had been seen at Fosheim Peninsula, the authors searched carefully but

unsuccessfully for it in 1955. However, Sim and Marsden saw "7 dark geese," probably Brant, near Iceberg Point on July 2. No specimens of Brant have been collected at Fosheim Peninsula, so far as known.

The taxonomy of the Brant is anything but clear, but most ornithologists agree that the breeding range of *Branta bernicla hrota* includes Ellesmere Island. There, on the north coast, both Feilden (1877) and MacMillan (1927) reported the finding of Brant nests in 1876 and 1909 respectively, but not MacDonald (1953) in 1951. On the east coast Brant were "comparatively numerous" in the vicinity of Discovery Harbour in 1881-83 according to Greely (1886), who also noted them at Cape Sabine in 1884. In southern Ellesmere Island, Brant bred abundantly in 1900-02 (Bay in Sverdrup, 1904). Two nestlings were collected at The Little Sandbar, Ellesmere Island, July 11, 1900, and six more nestlings, a brood about nine days old, at Winter Harbour, King Oscar Land, July 21, 1901, by the Second *Fram* Expedition (Schaanning, 1933).

Chen hyperborea (Pallas) Snow Goose

The Snow Goose is a common summer resident of the Fosheim Peninsula where it breeds abundantly in some years and scarcely at all in others. Although common and widely dispersed on the peninsula in 1955, remarkably few pairs of these birds bred. The Snow Geese of Ellesmere and Axel Heiberg islands belong to the race *Chen hyperborea atlantica*, popularly known as the Greater Snow Goose.

In Axel Heiberg Island, during July and August of 1955, Snow Geese were noted at several places on the east coast by the authors and on the west coast by R. Thorsteinsson of the Geological Survey of Canada (see account below).

Arrival. At Thule, Greenland, the Greater Snow Goose arrives in early June (Salomonsen, 1950-51). In Ellesmere Island, it was first noted on the north coast on June 13 in 1951 (MacDonald, 1953). At Fosheim Peninsula the arrival has been recorded several times. In 1951 Tener (Godfrey, 1953) first noted these geese near Slidre Fiord on May 31 (seven birds). The early arrival date of May 13 (one bird) recorded by Bruggermann (1953-54) near Slidre Fiord in 1953 must be exceptional; he next saw the species there on June 12 (two birds). In 1954, he first noted the species there on June 5 (two birds).

Many flocks arrived at Fosheim Peninsula in early June of 1955. They came from the south and southeast, some continuing northward. The first flock recorded was one of 10 birds (flying north), noted June 1 by Sim and Marsden several miles east of the head of Slidre Fiord. Sim and Marsden continued to see the species there—the largest flock (27 birds flying north) on June 3. On the ground the geese went about mostly in pairs. Some pairs appeared to have reached their breeding places as early as June 4, i.e., they did not migrate farther north. Most of the geese migrated east of Slidre Fiord, and they were not often seen near the fiord west of Eureka where, on June 17, the authors collected the male (largest testis 35.0 by 25.0 mm) of a pair that was flying.

Nesting. The Greater Snow Goose breeds at high latitudes principally in eastern parts of the Canadian Arctic Archipelago. Clear-cut information exists concerning its nesting on Bylot Island and northeastern Baffin Island. It has been found nesting on Devon Island (White and Lewis, 1937), and a female and downy young were collected on Somerset Island (Short and Peters, 1942). In recent years nestings have been reported from Mökka Fiord, Axel Heiberg Island (Porsild, 1955), and from various parts of Ellesmere Island by a number of observers. Two small colonies in the Thule District, Greenland, are only an offshoot of the American population, but they have been reported repeatedly (Salomonsen, 1950-51).

In former years explorers found Snow Geese decidedly scarce or absent in Ellesmere Island, despite the fact that they travelled extensively and were ever watchful for birds. Neither Feilden (1877) nor MacMillan (1918) reported the species from the north coast where MacDonald (1953) secured a flightless juvenile on August 14, 1951. Greely (1886) mentions but two pairs of Snow Geese—one near Fort Conger on June 12, 1882, the other at Sun Bay (Grinnell Land) on June 13, 1882. Since Greely's time, however, nestings have been reported from the vicinity of Lake Hazen (White and Lewis, 1937; Hamilton, 1941; Snyder, 1957). Bay (in Sverdrup, 1904) did not list the species at all for southern Ellesmere Island, including Goose Fiord where Brant bred in great abundance. Years later, according to Hamilton (1941), Snow Geese bred (several nests found) at the head of Goose Fiord. If in former years Snow Geese had been anywhere nearly as abundant as they are today in Ellesmere Island, all of these early observers would have surely noted them time and again.

Since the establishment of Eureka at Slidre Fiord in 1947, there have been numerous reports on the nesting of Snow Geese in the vicinity. Some of these reports, recorded in the station yearbooks, are vague. According to the 1947 yearbook, one pair nested near a small tundra pond close to Eureka. That year Duvall and Handley (1948) were told that geese had nested at lakes 12 miles inland; but when they visited the nest area on August 9 and 10, they saw no young among the 150 adult birds.

Tener (Godfrey, 1953) found Snow Geese but no evidence of their nesting at Fosheim peninsula in 1951. Apparently the species bred abundantly there in 1953, for Bruggemann (1953-54) noted a number of nestings. On June 23 he found the remains of a goose nest in the narrow gravel belt between the tundra and beach of Slidre Fiord. On the south shore of Greely Fiord he saw a pair of geese with four downy young on July 11. In the vicinity of Eastwind Lake he recorded a pair with downy young on July 12; four pairs, with seven, five, four, and one young respectively, on July 22; 10 pairs with 30 or more young on July 23. He later estimated that there were 30 adults and 50 goslings there. At a small pond near Eureka on August 19 he saw two pairs with six young barely able to fly.

Few geese nested at Fosheim Peninsula the following year, for Bruggemann (1953-54) calls attention to the "striking contrast" between the abundance of nesting geese in 1953 and their scarcity in 1954. He did, however, find a nest with seven eggs on a point of land in a pond south of Eastwind Lake on June 26. On July 15 the nest and egg remains were scattered. On August 5 he saw a pair with one young (exact locality on peninsula not stated) and on August 19 four adults with four young.

Almost the entire population of Snow Geese in the Slidre Fiord area failed to nest in 1955. The authors first thought these large numbers of non-breeding birds were immature, and probably many of them were. But in watching the flocks it was noted that many geese moved about in groups of two. The flocks seemed to be composed mostly of paired birds. Some of these geese engaged in aggressive, threatening displays after the usual egg-laying season.

On a small islet in one of the larger ponds south of Eastwind Lake, the authors found the remains of a goose nest on June 26. Shell fragments were on the marsh tundra near by. It was concluded that this nest was destroyed when ice still covered the pond, for the water separating the islet from the main shore was deep. No other geese nested in the vicinity, though a number of them fed in a lush grassy area just east of Eastwind Lake. The largest number seen at the lake was 35 (flocks of 24 and 11, June 29).

During a 40-mile hike north of Eastwind Lake, June 30 to July 1, the authors saw a number of Snow Geese but found no evidence of their nesting. The largest flock numbered 27. All of these birds could fly, and many of them were paired.

On July 2 Sim and Marsden found a nest with six eggs in northwestern Fosheim Peninsula, about 8 miles south of Iceberg Point and 3 miles east of Eureka Sound. The authors made a special trip to see this nest, arriving July 11 when they found two of the eggs pipped. When approached, the goose dropped her head and remained on the nest with neck outstretched along the ground. The gander, close by, was not aggressive. Once flushed, both flew out of sight. The nest was a 14-inch-wide scrape, neatly lined with down and small feathers. Tufts of moss plucked within one foot of the nest were mixed with the down. Most interesting was the habitat, for here the ground (700 feet elevation) was dry and sandy with scattered pebbly debris and practically no plants. The closest lake was 5 miles away.

On July 18 the authors found the scattered remains of another nest, this one having been placed in a vegetated, trough-like depression in the gravel of a creek delta at Slidre Fiord. A broken shell was close by. This site was used by geese before 1955. In pawing at the nest, the predator had exposed an old one directly beneath it.

According to Ekblaw (in Salomonsen, 1950-51), the period of incubation is four weeks. If this is true, egg-laying at one Fosheim Peninsula nest probably commenced about June 8, since the eggs were pipped by July 11. The occurrence of a brood on July 11 and another on July 12 (see above) likewise indicates the completion of the clutch before mid-June. Salomonsen (1950-51) states that egg-laying in Greenland takes place "after mid-June," and hatching "about mid-July." This accounts for the incubation period of "four weeks," but does not allow enough time for egg-laying. Perhaps the period of incubation is closer to that of the Lesser Snow Goose (*C. h. hyperborea*), which has an incubation period that averages only 22 days (Manning, 1942).

Very few young geese were noted at Fosheim Peninsula in 1955. Eureka personnel reported seeing near the south shore of Slidre Fiord on August 25, two old birds and six grey goslings that could barely fly. The authors

investigated the following day and found four adults and four goslings. Three of the adults immediately flew off, but the fourth led the young far out on the fiord waters. When pursued, two of the young flew strongly, but the other two, after several short flights, made no further attempt to rise. When pursued closely, one dived to a depth of 5 feet and swam 20 to 30 yards before surfacing. This it did repeatedly for 20 minutes until captured.

Moult. According to Salomonsen (1950-51), adult Greater Snow Geese in Greenland regularly shed their remiges in late July, and some "immature, non-breeding" birds regain their flight powers by August 6. This gives the impression that non-breeding birds moult early, a probability confirmed by the authors' observations. Tener (Godfrey, 1953) saw 32 flightless geese as early as July 8 in 1951. Flights of geese fell off sharply by mid-July in 1955. Whether these early moulting birds are immature or adult or both is uncertain. The 150 adult (possibly sub-adult) geese seen by Duvall and Handley (*see above*) on August 9 and 10 were all able to fly.

Departure. The southward migration of Greater Snow Geese from Greenland occurs "slightly before mid Sept., as soon as the moult is finished and the young are fledged" (Salomonsen, 1950-51). Non-breeding birds leave the Fosheim Peninsula much earlier. Flocks were already migrating south before some goslings fledged in 1955. On August 20 a clamorous flock of 30 flew directly south several thousand feet above the peninsula, and on August 23 another clamorous flock of 36 flew directly south, high above the peninsula. Most of the peninsula geese were gone a few days later. In 1954 Bruggemann (1953-54) noted 215 geese on August 20, but none after that. The latest known date for the species at Fosheim Peninsula is August 28 (1955). Six adult and five young birds, all flying well, were seen by Eureka personnel at Slidre Fiord on that date.

Axel Heiberg Island. Greater Snow Geese were abundant, but apparently few bred in east-central Axel Heiberg Island in 1955. They were especially numerous on the Schei Peninsula where, during a single helicopter flight on July 23, the authors counted over 400 of them, scattered in groups up to 30, on lakes and ponds. All appeared to be flightless, and no young were with them. A separate pair had several small young.

On July 23, at 80° 42' 40" N., 90° 59' W., about 18 miles northwest of Stang Bay, the authors collected a pair of Greater Snow Geese and their two downy young at a small lake in high, well-vegetated country, 3 miles from the coast. The adults had not yet shed their remiges. All four birds had recently eaten grass. Other Snow Geese (three pairs) were seen within a mile of there, but no young were with them.

On July 25, at 80° 20' N., 89° 16' W., about five miles west of Flat Sound, the authors found broken shells of goose eggs from another year. They were between low rocky ridges on a well-vegetated slope.

A number of pairs of Snow Geese bred on the west-central coast in 1955. On August 1 to 3, R. Thorsteinsson saw a pair with three large but flightless goslings on a lake near South Fiord. At another lake, several miles away, he noted 30 adults (no young). When first observed, August 9, about half of these were flightless; all flew well by August 13. Near

Strand Fiord, August 18, he saw two widely separated groups, one containing six adults and 14 young, the other, 16 adults and 14 young. None of these birds was flightless. No specimens from the west coast were collected, but it seems likely that *C. h. atlantica* is the race that breeds there. It is certain that the species breeds extensively in Axel Heiberg Island.

Predation. The remains of an adult Greater Snow Goose was found inland at Fosheim Peninsula in 1955, but other than that, there was little evidence of predation of adult geese. A large, nearly fledged gosling was attacked repeatedly by a Glaucous Gull (*Larus hyperboreus*) at Slidre Fiord. Had the authors not intervened, the gull would have surely killed it in the absence of a parent bird.

The nest of the Greater Snow Goose is vulnerable, as the record clearly indicates. In this respect it is interesting that this goose displays more latitude in choice of nest site than any other bird of the region. It places its nest just above the beach near salt water, on a river delta, at the edge of or on an islet in a freshwater pond, or far from water on a high barren slope or on a well-vegetated slope. Its choice of nest site, in the long run, is all important to its nesting success. Throughout their residence, the authors carefully noted the movements of two major predators—the arctic fox and wolf. These animals regularly patrol the shores of both fresh and salt waters, and geese nesting there are in great danger of losing their eggs. A nest in the desolate interior, on the other hand, is comparatively safe from these predators. One has to note the movements of the predators day after day to appreciate this fact.

Non-breeding years. Why so few Greater Snow Geese nested at Fosheim Peninsula in 1955 remains a puzzling question. True, the spring thaw was late; but the 1954 thaw was early, and only a few geese nested that year. Greater Snow Geese may rotate their nesting sites, as appeared to be the case on Bylot Island in 1953 (Scherman, 1956); but geese were on the Fosheim Peninsula breeding grounds in large numbers in 1955. Most of them simply did not nest. The presence of predators may well have been a major factor. So common were foxes and wolves in 1955, that the authors wondered how a goose nest on any shore or colonial nesting ground could escape destruction. The importance of predation was also noted by Marshall (1952) in his study of non-breeding sexually mature birds on Jan Mayen. Whatever the causes, Greater Snow Geese do not breed successfully at Fosheim Peninsula each year. When conditions are right, they probably form loose colonies (extremely large colonies are not known for the region) and produce many young; otherwise only a few nest in widely separated pairs.

Specimens. One adult male (weight 2.6 kg, wing chord 434.0 mm, exposed culmen 64.5, tarsus 83.5) was collected at Fosheim Peninsula June 17, 1955. One adult male (weight 3.2, wing chord 444.0, exposed culmen 69.0, tarsus 86.0) and one adult female (weight 2.5, wing chord 433.0, exposed culmen 58.0, tarsus 79.0) were collected in Axel Heiberg Island (82° 42' 40" N., 90° 59' W.) July 23, 1955. All three birds were lean. The plumage of all was much worn; all could fly, and none had started the postnuptial moult. Only the female had a brood patch.

Although the 1955 Fosheim Peninsula male is small, all eight males collected there by Duvall and Handley (1948) during August 9 to 10, 1947, weighed 7 to 8 pounds each.

Two downy siblings, a male (weight 213.5 gm, exposed culmen 24.0, tarsus 38.0) and female (weight 250.0, exposed culmen 24.0, tarsus 38.0) were collected with parents (*see above*) in Axel Heiberg Island July 23, 1955. The bills, eyes, legs, and feet were brown. There is a pronounced contrast in down colour of the dorsal and ventral surfaces. The gosling illustrated in Kortright (1942:453) does not show this pronounced contrast in down colour, and the legs and feet are shown as pinkish, similar to that of adults. Although more brownish and less greyish of upperparts, the Axel Heiberg downies closely resemble the goslings illustrated in Delacour (1954:192).

Annual breeding cycle. Greater Snow Geese arrive at the Fosheim Peninsula breeding grounds in late May or early June. Pairs on arrival remain inland, occurring uncommonly near the fiord coasts at that time. The nesting habitat is varied. Egg-laying probably culminates in mid-June. The known clutch size at Fosheim Peninsula is six or seven. The female incubates while the gander stands guard. Hatching commences as early as July 11. The young are led to water and are attended by both sexes. Fledged young occur as early as August 18, unfledged young as late as August 26. Non-breeding birds commence moulting in early July, breeding birds in late July or early August. Family groups remain inland or at the fiord coasts until their departure. Non-breeding birds migrate south as early as August 20, probably earlier. Snow Geese have not been observed at Fosheim Peninsula in September.

***Clangula hyemalis* (Linnaeus) Oldsquaw**

The Oldsquaw has been reported as breeding on the Fosheim Peninsula since 1947. In 1955 it was noted at most lake areas visited in June and July. During August and the first half of September, it was by far the commonest bird on the open waters of Slidre Fiord.

On the Schei Peninsula, in Axel Heiberg Island, on July 25, 1955, the authors collected a female Oldsquaw and six downy young at a tundra pond. Close by was another female with five downy young.

Arrival. In northern Greenland, Oldsquaws return to their breeding grounds June 5 to 18; usually in pairs, they make their way north as soon as the first leads form along the coast (Salomonsen, 1950-51). Very likely the same is true for northern Ellesmere Island. The earliest arrival date for Alert on the north coast is May 28 (four birds, MacDonald, 1953). On the Fosheim Peninsula in 1951, Tener (Godfrey, 1953) first noted the species at Slidre Fiord on June 16 (two pairs). Bruggemann (1953-54) first noted it there on June 6 (eight birds) in 1953, and on June 5 (two birds) in 1954.

In 1955, Oldsquaws were first noted at Slidre Fiord on June 11—five days after the streams had spilled over the fiord ice. Three males and two females were on the inundated sea-ice near Eureka, and another mixed

flock of six flew by there. On June 13 the authors collected a pair (male: largest testis 30.0 by 19.0 mm; female: largest ovum 14.0) that had flown in close to Eureka.

The authors continued to see Oldsquaws in the shore leads during June. As early as June 14, Sim and Marsden saw them well inland also. Some were on temporary runoffs, others on such lakes as were thawed. Most of these birds were paired.

Nesting. The species has bred extensively in Ellesmere Island. On the north coast MacMillan (1918) found a nest with five eggs on June 28, 1909, and MacDonald (1953) noted young (brood of two) in 1951. Although Greely (1886) reported no nestings in 1881-83, he found Oldsquaws "not uncommon" in the vicinity of Discovery Harbour on the east coast and in the interior of Grinnell Land. In southern Ellesmere Island nests were often found "near freshwater lakes" (Bay, in Sverdrup, 1904). According to Schaanning (1933) a clutch of three eggs was collected by the Second *Fram* Expedition at Indre Eide, Ellesmere Island, on July 21, 1901.

On the Fosheim Peninsula, Duvall and Handley (1948) noted five "nearly full-grown" young and two adult Oldsquaws in Slidre Fiord, and one female with five young 12 miles northeast of Eureka on August 9 and 10, 1947. Hatfield (in Handley, unpub. MS.) saw broods in 1949 but recorded no precise data. Bruggemann (1953-54) saw a female with five downy young near Eastwind Lake on July 23, 1953; a female with five downy young in the same area on July 20, 1954; and a female with five downy young in Slidre Fiord on August 10, 1954.

In 1955, pairs of Oldsquaws were well established at the inland breeding places by late June and early July. The authors noted three pairs on ponds near Eastwind Lake on June 29, and 12 scattered pairs at ponds on the plain north of the lake during June 30 to July 1. On July 2, Sim and Marsden noted 14 pairs at ponds near Iceberg Point. Pairs were last seen inland on July 11.

Near Eastwind Lake on July 9, the authors found an incubating female Oldsquaw on a nest (538 feet elevation) in dry, hummocky tundra, a hundred yards from a large pond. The six eggs were nearly fresh. On July 12 the nest held four eggs only, but these were warm and down-covered. On July 14 the nest was devoid of eggs and abandoned. Long-tailed Jaegers, several pairs of which patrolled the tundra thereabout, likely ate the eggs.

On July 30 the authors noted a female and six small downies at a lake (about 700 feet elevation) in barren country. Flightless young (10 birds, probably several broods, with one adult female) were noted as late as September 2 in Slidre Fiord. These young appeared to be only three-quarters grown. By September 5, inland waters were covered with an inch or more of ice. Eastwind Lake was frozen shut, except for a pool kept open in the middle by an active flock of adult and large young Oldsquaws, some or all of which may have been incapable of flight.

Summer flocking. Tener (*Godfrey*, 1953) noted flocking of drake Oldsquaws at Slidre Fiord in early July of 1951. Bruggemann (1953-54) saw 302 Oldsquaws at the fiord on August 1, 1954. Small mixed flocks

of these ducks were occasionally seen at Slidre Fiord in July of 1955, but large numbers were not seen there until August 1, on which date 50 were noted by Sim and Marsden.

From mid-August to September 9, the authors saw many flocks of up to about 200 Oldsquaws of both sexes on the fiord. Many Oldsquaws moulted there in August. In certain places the water was covered with feathers. Flightless adults were observed August 20 to 26, but none were seen in September. A male and female collected September 2 had new remiges and were flying well.

Departure. In northern Greenland, autumn migration of Oldsquaws starts as early as the first days of September (Salomonsen, 1950-51). On the north coast of Ellesmere Island in 1875, two Oldsquaws were shot as late as September 16 (Feilden, 1877). At Fosheim Peninsula in 1953, Bruggemann (1953-54) last noted Oldsquaws (six birds) at Slidre Fiord on September 10; in 1954 he counted 315 on September 14 but saw none thereafter. Large numbers of Oldsquaws were not observed after September 9 in 1955, but some remained until September 15, on which date the authors noted small companies (six to nine birds) feeding in such waters as were still open. The fiord was rapidly freezing over at that time.

Specimens. An adult male [weight 715.0 gm, wing chord 219.0 mm (flattened wing 227.0), tail 184.0, exposed culmen 26.5, tarsus 35.5] and adult female [weight 677.0, wing chord 209.0 (flattened wing 216.0), exposed culmen 25.0, tarsus 33.5] collected at Slidre Fiord June 13, 1955, were paired and in breeding plumage. An adult female (weight 552.6, wing chord 201.0, exposed culmen 26.5, tarsus 30.5) collected inland at Schei Peninsula, Axel Heiberg Island, July 25, 1955, was not moulting, although its plumage, including flight feathers, was worn.

A male (weight 883.0, wing chord 204.0, tail 88.0, exposed culmen 27.0, tarsus 32.0) and female (weight 730.5, wing chord 193.0, exposed culmen 26.0, tarsus 30.5) collected at Slidre Fiord September 2, 1955, were in heavy body moult, but they had already acquired their new remiges. The central rectrices of the male were incoming and still sheathed at the base. These two birds were not birds of the year, but whether they had bred or not is questionable.

Six small downy siblings were collected at Schei Peninsula on July 25, 1955. Two were males (weight 29.0 to 32.5, exposed culmen 10.5 each, tarsus 17.0 each) and four were females [weight 26.0 to 31.5 (av. 29.1), exposed culmen 10.0 to 10.3 (10.1), tarsus 16.5 to 17.5 (17.0)]. The underparts of one female are buffier than those of its siblings, but are like those of a male Baffin Island downy¹ of about the same age.

Annual breeding cycle. Oldsquaws arrive at Slidre Fiord in early and mid-June. Some of these birds are paired. They feed and rest in the leads of the fiord until fresh waters open. Some go inland as early as June 14. Egg-laying probably takes place from late June to late July. During this period from one to several pairs occupy a tundra pond or larger lake in well-vegetated or barren country. The one nest found in 1955 was in dry, hummocky tundra well back from water. The clutch size

¹Specimen in Sutton Collection.

was six, and the eggs were nearly fresh on July 9. Drakes start to gather in flocks in early July. Young commence hatching as early as July 20. Single broods usually number five or six chicks. Some young birds may attain virtually full growth in mid-August, others remaining flightless into early September. Large flocks of adults and young gather in Slidre Fiord in early August and hundreds of birds moult there. Flightless adults have been noted as late as August 26. Some Oldsquaws remain at the fresh waters until freeze-up in early September. Many Oldsquaws leave the region in early September, but some remain well into mid-September, feeding in such marine waters as remain open.

***Somateria spectabilis* (Linnaeus) King Eider**

The King Eider has been reported as uncommon on the Fosheim Peninsula by several observers since 1947. In 1955 it was conspicuous and widely distributed on the peninsula, but not abundant. It was noted a number of times at Slidre Fiord and far inland where it nested. The Common Eider (*Somateria mollissima*) has never been recorded on or near the peninsula, so far as known. Owing to the ice-blocked seas and the lack of nesting islands, it is unlikely that the species breeds anywhere in the region. All eiders seen inland are referred to *spectabilis*, on the assumption that *mollissima* would not normally be found there. Non-breeding young King Eiders probably do not summer in this region (Bent, 1925).

In Axel Heiberg Island, at 80° 12' N., 87° 54' W. on the Schei Peninsula, the authors saw a single female King Eider inland on July 25, 1955.

Arrival. In Greenland the King Eider moves north in April and May as far as the ice permits, arriving at high latitudes as early as June 8 (Salomonsen, 1950-51). On the north coast of Ellesmere Island, Feilden (1877) noted several mixed flocks of 10 to 20 birds at the end of June, 1876, and MacDonald (1953) noted two birds on June 19, 1951. The earliest recorded date for Discovery Harbour on the east coast is June 11 in 1883 (Greely, 1886); for Cape Sabine, May 26, 1884 (Greely, 1886).

On the Fosheim Peninsula in 1951, Tener (Godfrey, 1953) first noted King Eiders (two pairs) at Slidre Fiord on June 16. Bruggemann (1953-54) first recorded them there on June 12 (eight pairs) in 1953 and on June 27 (flock of three males and four females) in 1954. King Eiders were first noted by the authors at Slidre Fiord in 1955 on June 11 (one pair, flying). Near Eureka on June 12 there were four males and four females together on a shore lead, and a separate pair flying; on June 13 there were two males flying, and a single male on the inundated sea-ice near shore. Thereafter no eiders were seen at the fiord in June, but as early as June 14, Sim and Marsden noted three males with four females far inland at a lake 18 miles northeast of the head of Slidre Fiord. At the same place on June 18, they noted six eiders (sex not recorded) at one pool, four pairs at another pool, and two pairs at a large lake.

Nesting. Several King Eider nests with fresh eggs were found at Floeberg Beach on the north coast of Ellesmere Island in mid-July, 1876 (Feilden, 1877). MacDonald (1953) found the species quite common on the north coast in 1951, but he saw no nests or young. Apparently Greely

(1886) did not note a nesting of this species on the east coast; nor did Bay (in Sverdrup, 1904) on the south coast where King Eiders were "frequently" observed.

On the Fosheim Peninsula in 1947, Duvall and Handley (1948) saw two family groups, including ten quarter-grown young at a lake 12 miles northeast of Eureka. Hatfield (in Handley, unpub. MS.) saw downy chicks on Slidre Fiord in 1949, but he did not record the date. Bruggemann (1953-54) estimated that two or three pairs nested on the peninsula in 1953. Between June 12 and July 21, he noted 32 birds, including a female with two young (July 21). In 1954 Bruggemann (1953-54) noted 58 birds, including young, between June 27 and September 3. On August 3 he saw two females with 12 young, 7 miles east of the head of Slidre Fiord.

In 1955 King Eiders were more abundant. Probably 15 or more pairs bred on the peninsula north of Slidre Fiord, excluding the vast area east of the fiord where the species was noted in June. Although 12 drakes were together at Eastwind Lake (June 28-29), as were four drakes and nine hens at ponds near Iceberg Point (July 2, by Sim and Marsden) and seven hens near Iceberg Point (July 11), the eiders were usually more scattered inland. During June 30 to July 1, a 40-mile search through what appeared to be one of the most promising areas on the peninsula yielded only 19 eiders (one pair, one lone drake, three pairs, two pairs, three pairs). This thin scattering of pairs on inland breeding grounds is, however, characteristic of *S. spectabilis*. No King Eider nests have been found on the Fosheim Peninsula, so far as known. On July 30 the authors noted a hen with six small young on a pond south of Eastwind Lake.

Departure. Salomonsen (1950-51) states that as soon as egg-laying starts the drake "disappears and moves to the coast where it soon begins to migrate southwards"; that the breeding area is vacated by females with young in late August and early September, but that "very little" is known about their migration. The departure of the species is not well known for Ellesmere Island. A male King Eider was collected at Craig Harbour on the south coast August 26, 1938 (Shortt and Peters, 1942). On the Fosheim Peninsula, in 1951, Tener (Godfrey, 1953) noted drakes "in flocks" as late as July 9. In 1955 no drakes were seen inland after July 2, but the latest date for a drake on Slidre Fiord was August 4 (one bird). Flocks of up to 25 Brown Eiders, supposedly *spectabilis*, were seen infrequently on Slidre Fiord during August. None of these birds was flightless when noted.

Bruggemann's (1953-54) latest date for the species at Slidre Fiord is September 3, 1954 (20 or more birds in flock). The authors' latest date is September 2, 1955 (one in flight). Latest autumn record for northern Greenland is September 11 (Salomonsen, 1950-51).

Annual breeding cycle. Drake and hen King Eiders arrive together at Slidre Fiord in mid-June after the shore leads start to open. They soon abandon the leads and go inland. Flocking continues into July, but by this time most birds are paired. The species nests non-colonially inland on the tundra. Egg-laying probably begins in late June and culminates in July. Young have been seen as early as July 21. Drakes leave the

nesting grounds in early July, but some continue to frequent the fiords until early August. The only eiders seen on Slidre Fiord from mid-August to early September have been brown.

Falco rusticolus Linnaeus Gyr Falcon

The Gyr Falcon has been noted a number of times on the Fosheim Peninsula since the establishment of Eureka. Most records are of birds seen at the weather station in autumn. The species nests on the peninsula, probably in widely scattered pairs.

Opinion differs as to how many races of Gyr Falcons should be recognized. The American Ornithologists' Union (1957) recognizes the race *obsoletus* but does not recognize a white form, *candicans*, which is the form recognized by Salomonsen (1950-51) for high-arctic Greenland. The matter is further complicated by an apparent east-west cline of relative primary length that cuts across the "boundaries" of *obsoletus* and *candicans* in North America (Manning, *et al.*, 1956). Whether or not *candicans* is a valid subspecies, nearly all Gyr Falcons reported from the Fosheim Peninsula are white and are, perhaps, best referred to *candicans*.

Arrival. The Gyr Falcon returns to high-arctic Greenland in late April or early May (Salomonsen, 1950-51). In Ellesmere Island, MacDonald (1953) saw a single bird on the north coast on May 23, 1951. Bruggemann (1953-54) saw one at Slidre Fiord on May 25 in 1953 and one on May 22 in 1954. In 1955 the authors first saw the species on May 12—a white individual flying near Eureka.

Nesting. The breeding distribution of the Gyr Falcon in Canada is poorly known (Godfrey, 1953). Gyr Falcons have been reported regularly from Ellesmere Island, but apparently few eyries were noted. Feilden (1877) mentions a nest found by Hart on the east coast (Cape Hayes, 79° 41' N.). MacMillan (1927:180) noted a pair at an eyrie near the head of Bay Fiord on May 26, 1924. Several Gyr Falcons were shot in southern Ellesmere Island by members of the Second *Fram* Expedition (Bay, in Sverdrup, 1904). The "Falkbergret" referred to by Sverdrup (1904, 2:308-9) almost certainly was the nesting place of Gyr Falcons (specimen shot).

On the Fosheim Peninsula, Bruggemann (1953-54) heard the "unmistakable noise of a young falcon being fed" on the west slope of Black Top Ridge on August 10, 1953; he thought that a pair nested along the same ridge the following year, but in neither year did he find the eyrie. In 1955 the authors looked in vain for an eyrie along the entire west slope of Black Top Ridge, but they saw a White Gyr Falcon there on July 6. Sim and Marsden saw a White Gyr Falcon on a pinnacle 13 miles northwest of Eureka on July 3.

On a 100-foot sandstone scarp 6 miles south of Slidre Fiord, the authors found an eyrie on August 22. Two young falcons were sitting together on a pinnacle close by. An adult, among higher rocks, called continually in loud screams and squeals, occasionally flying out overhead. The authors collected the young, both of which were fledged. The adult, which flew off and did not return, was very white, though its plumage obviously

was worn and dirty. The nest ledge, which the authors could look into but not climb to, was partially overhung with rock and faced east. Near by were several white-washed ledges, perhaps old nest sites.

The young falcons had been feeding on the remains of a Snow Bunting and a Long-tailed Jaeger juvenile. Along the scarp were numerous pellets and remains of arctic hares, Snow Buntings, and another Long-tailed Jaeger juvenile.

Departure. Autumn migration of Gyrfalcons in northwest Greenland takes place from early September to late October, in northeast Greenland from late August to the end of September (Salomonsen, 1950-51). Gyrfalcons have been seen regularly in the autumn at Eureka. Duvall and Handley (1948) saw one there on August 28, 1948. Hatfield (in Handley, unpub. MS.) noted a few in the autumn of 1949, as many as four appearing at one time, some remaining for several days. Two juveniles were collected on September 4, 1950 (Godfrey, 1953). Bruggemann (1953-54), in 1953, saw two on August 30; two, September 8; two, September 13; one, September 14; and one, September 17; in 1954 he saw one on September 14. All but one of these birds were white. According to Hatfield (in Handley, unpub. MS.) an individual seen once in the autumn of 1948, was "light slate thruout."

A young White Gyrfalcon shot near Eureka on September 9, 1955, probably was a transient. Its crop and stomach contained the remains of four Snow Buntings. That day another white individual flew into Eureka from the west. On September 10 a white individual flushed from an ice-floe near Eureka. The authors last saw the species on September 13—a white individual perched on an antenna mast at Eureka.

Specimens. The two young Gyrfalcon siblings (male: weight 1266.0 gm, wing chord 304.0 mm, tail 173.0; female: weight 1339.5, wing chord 299.0, tail 170.0) collected south of Slidre Fiord on August 22, 1955, had many head and body feathers and all flight feathers sheathed at the base. Both birds are white and rather heavily streaked with brown, but the male is conspicuously more heavily streaked than the female.

The first winter plumage of the well-developed young female (wing chord 363.0, tail 205.0) collected near Eureka on September 9, 1955, is white, moderately streaked.

Annual breeding cycle. The Gyrfalcon arrives at Fosheim Peninsula as early as mid-May, probably earlier. Near Slidre Fiord a brood fledged about the third week in August—about the time that broods fledge in high-arctic Greenland (Salomonsen, 1950-51). Autumn migrants, probably attracted by large numbers of Snow Buntings, appear both singly and in small flocks along the shore of Slidre Fiord in late August and September, the latest record being September 17.

Lagopus mutus (Montin) Rock Ptarmigan

The Rock Ptarmigan has been reported regularly from the Fosheim Peninsula where it breeds. None of these records, however, indicate an abundance of birds. In the spring and summer of 1955 it was thinly scattered over the peninsula at various elevations. It was locally abundant in the autumn when flocking occurred.

In the eastern parts of the Canadian Arctic Archipelago the Rock Ptarmigan shows an extraordinary variation since it is influenced by several distinct races (Salomonsen, 1950-51). Although two or three races may well influence Ellesmere Island ptarmigans, these birds are best referred to *Lagopus mutus captus*. They are not typical of that race, but they approach it in size. The females in winter feather also show the extended loreal streak that is characteristic of *captus* but rare or lacking in other races.

On Axel Heiberg Island in 1955, the authors noted a pair of Rock Ptarmigan near the head of Mökka Fiord on May 14; they also noted shed feathers 18 miles northwest of the mouth of Stang Bay on July 23, and 5 miles west of Flat Sound on July 25.

Spring records. MacMillan (1918) noted the species on Ward Hunt Island (83°7'N.) near the north coast of Ellesmere Island as early as March 21 in 1909. At Cape Sabine on the east coast, it was observed as early as March 7 in 1884 (Greely, 1886). Bay (in Sverdrup, 1904) states that the species is found "all the year round" in southern Ellesmere Island, but that "many" migrate south from there in winter. Interestingly enough, MacMillan (1918) saw the species at 4,700 feet elevation while crossing the Beitstadt Glacier on March 19, 1914, when air temperatures were -50°F.

The species had been on the Fosheim Peninsula in 1955 for some time before the authors arrived there on April 16. The station personnel had seen a flock of five ptarmigan near the Eureka airstrip on April 1 (air temperature -40°F.), but according to them none had been seen in winter.

Ptarmigans were scattered in the Slidre Fiord area by late April. Most of them were in the lowlands. Their tracks and roosting beds were scarce inland, especially on the higher slopes. There was little evidence of flocking anywhere. Some birds were going about in pairs as early as April 22.

In early May the authors continued to find pairs of ptarmigan in certain places. Cocks seemed to be on territory, but these areas were not openly defended with so few birds about.

By mid-May some hen ptarmigans showed traces of the summer plumage. One seen on May 13 and another on May 14 had several dark crown feathers. By late May most hens were mottled on the head, neck, and back. Males retained their winter plumage well into summer, but some of them showed traces of the summer plumage in late May. A cock seen May 31 had several coloured crown feathers. This bird's mate had lost half of its winter plumage. Hen ptarmigans had, essentially, their summer plumage by June 10 when egg-laying was well under way, but three different males had not yet started to moult when last seen on June 19, 20, and 25 respectively.

Nesting. There are few nest or brood records of ptarmigan for all of Ellesmere Island. This is surprising in view of the fact that the species has been reported repeatedly from all coasts and parts of the interior. According to Schaanning (1933) a nestling was collected at Hayes Sound in July of 1899 by the Second *Fram* Expedition.

Bruggemann (1953-54) found the species decidedly scarce on the Fosheim Peninsula. In 1953 he estimated the breeding population at only four or five pairs. On July 28 he saw a female with two young near Slidre

Fiord. In 1954 he saw even fewer ptarmigans. He did, however, find a nest "among *Cassiope*-covered hummocks" on the bank of a stream 5 miles north of Eureka. On July 14 there were six eggs. On August 3, near the head of the fiord, he saw a hen with seven "half-grown chicks" and later saw "5 more young."

Ptarmigans were more plentiful in 1955, but they were not abundant. There was, on the average, one pair per square mile of tundra investigated. Surprisingly few courtship flights were noted. Males were never seen in combat.

The authors paid particular attention to a small valley about a mile northwest of Eureka where ptarmigans were regularly seen from April 22 on. A cock and three hens inhabited the area (for polygamy in this species as observed in Greenland see Nicholson, 1930). Their favourite area was a stretch of snow-free hummocks on the bank of a small creek. Here, by mid-May, were scores of feathers shed by the females. By late May, all four birds were much attached to the area—almost certainly the mating ground. The piebald hens ran about with heads and tails lowered, followed by the cock with partly spread tail held horizontally. On May 30 there were only two hens with the cock. From June 4 on, the hens were rarely seen, but the cock was noisy and conspicuous. Its lookout was a rocky prominence at the upper end of the valley. Here, visible for half a mile, it squatted on a rock. No other cocks were seen within a mile of this valley. When last seen (June 25) the cock was dirty and bedraggled but still white of body plumage. It then abandoned the hens and territory.

On July 5 the authors followed one of the hens to its nest in a barren patch of clay one-third mile from the fiord at 106 feet elevation and about 200 yards from the mating ground. An old ptarmigan's nest with bits of shell and bleached membrane was within a few feet of the mating ground.

The nest was a natural depression with a few dry grasses and feathers. It held 10 eggs, nine of them pipped. At 6.30 a.m. on July 6 the last egg was pipped, and the bills of some of the chicks were protruding. The last of the brood hatched at 4.32 p.m. All ten chicks were in the nest, some more lively than others. Some ran when touched. The authors caught the parent female by hand, marked its primaries red, and banded it.

Allowing 21 days for incubation (Salomonsen, 1950-51), the clutch of this nest was completed by June 15; the laying of the first egg (allowing a minimum of 24 hours between eggs) was not later than June 5. In southern Baffin Island a brood of Rock Ptarmigan hatched about July 6 (Sutton and Parmelee, 1956). Salomonsen (1950-51) states that egg-laying takes place no later in high-arctic Greenland than it does in low-arctic Greenland.

Although the authors failed to find the nest of the other hen, two broods were raised in the valley that season. On July 16 the banded hen and her brood (now seven chicks) were half a mile north of the nest. The 10-day-old chicks ran swiftly but did not fly. On July 21 two broods—that of the banded hen and a brood of 11 with an unmarked hen—were at the upper end of the valley, about three-quarters of a mile north of the nest. The banded hen had not yet shed its red-marked primaries. Its brood (now five chicks) scattered when flushed. Three could not be caught

by hand. The weakest flyer was caught after it had made three flights of about eight feet each. This chick (female: weight 97.5 gm, wing chord 97.0 mm; crop: seeds and insects), which was approximately 15 days, six hours old, was not fully fledged. Salomonsen (1950-51) states that a less than 10-day-old chick can fly "up to 10-15 m."

The unbanded hen and 11 chicks were seen again on July 22. When flushed, the chicks scattered in all directions, but some flew more strongly than others. One (female: weight 89.5, wing chord 95.0; crop: empty) was caught after it had made several short flights of about 10 feet each. Thus, the two broods were about the same age. After July 22, no ptarmigans, young or old, were seen in the valley in 1955.

No brood was encountered again until August 23 when a hen (collected) and eight chicks (only three-quarters grown) were noted a mile and a half south of Slidre Fiord. The brood did not scatter, but flew off strongly, staying together. No cock was about. The hen of this late brood clearly showed a delayed moult (*see* description under specimens).

Salomonsen (1950-51) states that in Greenland the cock ptarmigan abandons the hen before hatching time, usually moving into higher country to moult, and often returning when the young are two-thirds grown. Fosheim Peninsula males also abandoned the hens before hatching time. Few males were seen, however, in July and early August of 1955. Sim and Marsden saw one (old plumage) with a hen on Northwest Ridge July 1, and one by itself near Greely Fiord on July 2. A hen seen by Sim 9 miles east of Slidre Fiord on July 15 behaved as if young were close by, but no cock was seen anywhere in the vicinity.

A cock in autumn plumage collected near Slidre Fiord on August 4 already had its fresh winter remiges, lower breast and belly feathers; several winter feathers were appearing on its neck and upper dorsum. Three cocks collected near the fiord on August 20 to 23 had been moulting heavily, the neck of one being white with winter feathers. None of these males was with a hen or brood.

Autumn flocking. The earliest autumn flock reported from the Fosheim Peninsula was seen August 9, 1947 (Duvall and Handley, 1948). The authors came upon a compact flock of ptarmigan near Slidre Fiord on the morning of August 24, 1955. From the numerous fresh droppings it was evident that the 19 birds spent the night together. Of the 11 specimens collected, four were adult (two males, two females) and seven immature (four males, three females). All were moulting heavily. One of the adult hens was the one the authors had banded (July 6) at the nest—about a mile and a half from the spot at which it was shot.

Although fresh tracks were frequently seen on the slopes north of Slidre Fiord, ptarmigans were not encountered again until September 15, on which date the authors flushed a roosting flock of about 30 birds south of Eastwind Lake. These birds were largely white. Some birds of a flock of 30 seen September 21 north of Eastwind Lake retained a few brown feathers. Of the four specimens collected, two were young birds in almost complete winter feather. A flock of five birds seen near the lake on September 22 appeared white.

Bruggemann's (1953-54) latest date for the species at Fosheim Peninsula is September 17, 1953 (seven birds). In 1955 the Eureka station personnel kept watch for ptarmigans after the authors departed. They saw a flock of five (all white) near the airstrip on September 29. The air temperature that day averaged about 8°F.

It is not known if any ptarmigans remain all winter on the Fosheim Peninsula. Food is available there at all seasons, for the snow-cover is always thin. The species is resident in Greenland except in the "farthest" north (Salomonsen, 1950-51).

Predation. Few ptarmigan kills were noted at Fosheim Peninsula in 1955. The scattered old remains of one in winter plumage was near Eastwind Lake. At a Gyrfalcon's eyrie on August 22 to 23 there were no ptarmigan remains of any sort. The ptarmigan brood (Nest 1) under observation was depleted rapidly in July, but there was no evidence that the chicks had been killed by a predator. The cocks on territory chased Long-tailed Jaegers. Foxes were seen stalking adult ptarmigans unsuccessfully on several occasions.

Specimens. Many of the 22 adult and immature specimens collected at Fosheim Peninsula in 1955 had undeveloped primaries. The primaries of all August specimens are sheathed at the base and give minimum measurements. Since immature birds in first winter plumage give an accurate wing measurement (Salomonsen, 1950-51), the September 21 specimens are not separated according to age.

Flattened wing measurements of four adult Fosheim Peninsula males (202.0 to 210.0 mm, av. 205.0) collected August 20 to 24 and two Fosheim Peninsula males (204.0 to 218.0) collected September 21 average 207.0. Two males collected May 28 to June 13 at Fosheim Peninsula in 1951 measure 205.0 and 205.5 (Godfrey, 1953). A series of 14 males from Axel Heiberg and Ellesmere islands and northwest Greenland measure 206.0 to 212.0 (Salomonsen, 1950-51). Most of these birds are large for *L. m. rupestris* or *L. m. saturatus*, but small for *captus*. The only one typical of *captus* in size is the September Fosheim Peninsula male.

Fosheim Peninsula males are also intermediate in bill length (anterior edge of nasal fossa to tip) and weight. Bills of five adult Fosheim Peninsula males measure 10.0 to 11.0 (10.6). Bill measurements (Salomonsen, 1950-51) for male *saturatus* are 9.0 to 10.0 (10.0), for *captus*, 10.0 to 12.0 (10.9). Weights of four adult Fosheim Peninsula males in August to September plumage are 545.0 to 595.5 gm (568.8). Average weight (Salomonsen, 1950-51) for male *saturatus* in winter plumage is 526.0, for *captus*, 581.0.

A female (flattened wing 197.0) collected September 21 at Fosheim Peninsula approaches closely the average measurement (Salomonsen, 1950-51) of 200.0 for *captus*. Bill measurements for three adult Fosheim Peninsula females are 10.0 to 10.5 (10.1). Bill measurements (Salomonsen, 1950-51) for female *saturatus* are 9.0 to 11.0 (9.6), for *captus*, 10.0 to 11.0 (10.4).

All females in winter plumage observed by the authors at Fosheim Peninsula, as well as one at Mökka Fiord, Axel Heiberg Island, had a black loreal streak, which often extended even beyond the eye as in males. Sex identification of live, unpaired birds in winter plumage was thus difficult. The female collected September 21 has this loreal streak, which,

in this case, extended for at least 12 mm beyond the eye (exact measurements obscured by a few underlying brown feathers). If Salomonsen (1950-51) is correct in that females of *saturatus* and *rupestris* "never" have this extensive black loreal streak, this is indeed good evidence that Fosheim Peninsula ptarmigans are influenced by *captus*.

Four immature males and three immature females collected at Fosheim Peninsula on August 24, 1955, have the 8th primary undeveloped. Since the 9th and 10th first winter primaries develop first and are then followed in order by the 1st to 7th, the 8th is actually shorter than either the 7th or 9th in birds of this age. This is rightly described by Salomonsen (1939) and clearly illustrated by the above specimens.

The old primaries of all the specimens collected in August have been replaced, except for the 9th and 10th in one adult female. This bird, the hen of the late brood of August 23, clearly shows a delayed moult of the head, body, tail, and leg regions.

The female juvenile (wing chord 97.0, tail 31.5, bill 6.0) of known age (caught July 21 when 15 days old) closely resembles two sibling female juveniles¹ (wing chord 97.0 to 102.0, tail 37.0 to 39.0, bill 6.0 each) shot July 22, 1953, in southern Baffin Island. The only significant difference appears to be in the less developed tail of the Ellesmere Island bird. Both Baffin Island birds flew exceedingly well, whereas the Ellesmere Island bird did not. The close correlation in age is also indicative of a close correlation in the time of nesting. Although there are no profound differences in the juvenal plumages of the three specimens, the Ellesmere Island bird has noticeably fewer and lighter dark markings about the eye region. All three possess minute 9th and 10th first winter primaries.

Annual breeding cycle. Rock Ptarmigans occur in flocks on the Fosheim Peninsula as early as April 1. Some pair by April 22; these soon become strongly attached to certain areas which are not noticeably defended against other ptarmigans when the population is small. In 1955 one cock mated with two (perhaps three) hens. Hens commence moulting by mid-May, well before egg-laying. By late May they are half white and half brown. By June 10 the summer plumage is nearly complete. The summer plumage of the cock is much suppressed. Some cocks have brown crown feathers as early as May 31; others show no moult as late as June 25. The nest is in both barren and well-vegetated areas. Egg-laying starts in early June, but eggs have been found as late as July 14. The hen incubates and is deserted by the cock before hatching time, which commences in early July. Chicks hatch and leave the nest simultaneously; these are attended by the hen until after they are fledged and probably more than three-quarters grown. Fledging varies within the brood. Some 15-day-old chicks are very weak flyers and not fledged. Adult primaries are replaced by August 20, but delayed moulting may occur in females with tardy broods. The winter moult proceeds rapidly. Some adult males have new remiges and belly feathers in early August. Most young and old alike are piebald by late August, white by late September. Autumn flocking occurs as early as August 9, being common in late August and September. Ptarmigans have not been seen on the peninsula after September 29.

¹Specimens in Sutton Collection.

Charadrius hiaticula Linnaeus Ringed Plover

The Ringed Plover has been seen with certainty only once on the Fosheim Peninsula. Bruggemann (1953-54) noted a single bird, apparently not nesting, near Eastwind Lake on June 26, 1954. Although the authors were always watchful for this species, none were seen anywhere on the peninsula in 1955. Ellesmere Island birds are usually referred to the nominate race *Charadrius hiaticula hiaticula*.

On July 24, 1955, at 80°46' N., 88°23'40" W., on the northeast coast of Nansen Sound, about 18 miles southeast of Otto Fiord, the authors encountered the species at the wide delta of a braided stream whose gravelly bottom could be seen for miles. Of two pairs noted, a female (largest ovum, 1.5 mm) and two males (largest testis of one 7.0 by 3.0, of the other, 5.5 by 2.0) were collected. All three specimens had brood patches. Although no eggs or chicks were found, both pairs had defended special areas and, at times, feigned injury.

The species probably breeds sparingly in other parts of Ellesmere Island. MacDonald (1953) collected one (male with brood patches) of two birds seen on the north coast at Parr Inlet on July 18, 1951. On the east coast, at Buchanan Strait, Feilden (1877) collected a female with brood patches on August 4, 1875. The five plovers "found breeding" at about 81°35'N., 74°W., on the banks of the Very River, Grinnell Land, on July 1, 1882, were probably of this species (Greely, 1886). Apparently the Semipalmated Plover (*Charadrius semipalmatus*) has never been reported from Ellesmere Island. The breeding ranges of the Ringed and Semipalmated Plovers have met in Baffin Island at Cumberland Sound (Kumlien, 1879) and Clyde Inlet (Wynne-Edwards, 1952).

Specimens. The two males (weight 55.4 to 56.4 gm, wing chord 125.0 mm each, tail 55.5 to 59.5, exposed culmen 13.0 to 14.0, tarsus 23.0 to 24.0) and the female (weight 62.1, wing chord 128.0, tail 58.5, exposed culmen 13.5, tarsus 25.0) collected on the northeast coast of Nansen Sound on July 24, 1955, compare favourably in size with the male collected by MacDonald (1953) at Parr Inlet and later discussed by Godfrey (1953). The small size of these few Ellesmere Island specimens would seem to support the validity of *C. h. psammodroma*, a Faröes to Canada race, now abandoned by many taxonomists, including the American Ornithologists' Union (1957).

The pectoral bands of the Nansen Sound specimens are broad (males average 19.7 mm mid-ventrally; female 25.0), and the web between the inner and middle toes of each specimen is not developed as in *C. semipalmatus*.

Arenaria interpres (Linnaeus) Turnstone

The Turnstone has been an abundant bird of the Fosheim Peninsula. In 1955 it was the second commonest bird, the Snow Bunting being commonest. It was conspicuous at the fiord coasts in spring but not in summer, being confined mostly to well-vegetated areas during nesting. The young frequented the fiord beaches after fledging. Fosheim Peninsula Turnstones belong to the nominate race *Arenaria interpres interpres*, which winters in the Old World.

Sim and Marsden noted several adult Turnstones in the Caledonian Bay area of Canyon Fiord east of the Fosheim Peninsula on July 23, 1955. At 80°46'N., 88°23'40"W., on the northeast coast of Nansen Sound, the authors saw four adult Turnstones with at least three fledged young on July 24, 1955.

Arrival. In Greenland the spring migration of Turnstones is rapid; the species appears in low-arctic latitudes in middle or late May and reaches its high-arctic breeding ground early in June (Salomonsen, 1950-51). Its arrival on the north coast of Ellesmere Island was recorded by Feilden (1877) in 1876 and MacDonald (1953) in 1951, the dates being June 5 and June 2, respectively. At Cape Baird on the east coast it was first seen on June 2 in 1883 (Greely, 1886). At Fosheim Peninsula it has arrived in late May. In 1951, Tener (Godfrey, 1953) first saw it on May 31 (eight birds). In 1953 and 1954, Bruggemann (1953-54) first recorded it on May 26 (seven birds) and May 30 (one bird), respectively.

In 1955 the Turnstone was first seen May 27—a single bird flying erratically along frozen Slidre Fiord. Only a few Turnstones were seen the following two days, but by May 30 they were everywhere along the fiord beach and slopes near by. The collection of two males (largest testis 12.0 by 7.0 mm) on May 29 to 31 and two females (largest ovum 4.0) on May 30 and 31 indicates that the two sexes arrived at the same time, but it is not certain if the flocks were mixed on arrival. No migrating flocks were seen in June, and it appeared as if the whole Slidre Fiord population arrived within a span of five days.

The Turnstones did not go to their nesting areas immediately. They remained mostly near the beaches, along dry creek beds or in barren areas. Here, in companies up to 30 birds, they courted, the courtship reaching its height on June 5. Some Turnstones went about in pairs on June 6. Then their numbers declined dramatically along the fiord shores. Only three individuals were seen there on June 7 and none (adult) after June 9. The entire population seemed to settle on the inland nesting grounds at once.

Nesting. The Turnstone has been reported as common in summer from all coasts of Ellesmere Island, but apparently there are no records of nestings previous to 1955, although many fledged juveniles have been collected at the coasts.

At Fosheim Peninsula in 1955, the majority of Turnstones settled in the well-vegetated hummocky areas where Knots were also common. On June 10 these areas were still mostly snow-covered, but the thaw was rapid, and numerous spots of exposed ground and turf pock-marked the white ridges. In such snow-free places, the Turnstones started to lay their eggs. The authors did not observe what they recognized as territorial defence before or during egg-laying. From the first of their actual nesting, the Turnstones seemed to be completely tolerant of one another and also of Knots which walked unmolested close to Turnstone eggs. Other species they chased vigorously.

Data concerning 20 Turnstone nests found in 1955 are summarized below:

Nest No.	Date found	Contents when found	Clutch size	No. young hatched	Date of hatching
1	June 10	eggs 0	4	4	July 5-6
2	12	3	4	4	4
3	13	3	4	4	4-5
4	13	3	4	4	4-5
5	14	3	(one broken and nest abandoned)	—	—
6	14	4		4 (collected June 14)	—
7	14	4		—	—
8	17	4		4 (collected June 17)	—
9	17	4		4 (collected June 17)	—
10	17	4	4 (collected June 17)	—	—
11	17	4	4 (collected June 19)	—	—
12	18	4	4	—	—
13	20	4	4	3	6
14	22	4	4	—	—
15	28	4	4	—	—
16	28	4	4	4	4
17	28	4	4 (destroyed by predator)	—	—
18	29	4	4	4	4-5
19	30	4	4	3	5
20	July 4	3 young, 1 egg	4	4	4-5

Eggs collected on June 14 were nearly fresh; those collected June 17 contained small embryos; those collected June 19 contained embryos somewhat larger than those of the 17th. Each of these many eggs probably had been laid during June 10 to 14.

All of these nests were in areas that were often wet and hummocky and where willow, dryas, and heather were noticeable. The nest site was varied. Some nests were in dense vegetation, others in dry earth, others in wet mud. Those in vegetation or dry earth were scantily lined; those in mud were large and well built, being composed of twigs, grasses, and dry leaves. Scarcity of vegetation did not force the species to nest in the mud, for thick vegetation was always close by. None of the Fosheim Peninsula nests were in a stony area, and none were sheltered by vegetation, as is generally the case in Greenland (Salomonsen, 1950-51). Most of the nests were on the plain north of Slidre Fiord at 165 to 643 feet elevation. One nest was about a mile from the fiord coast; none was found closer; two were nearly 20 miles inland (northeastern Fosheim Peninsula). Two nests were 130 yards apart.

Apparently the incubation period, i.e., the time interval from laying to hatching of the last egg of the clutch, has not been reported for the species (Bent, 1929; Witherby, *et al.*, 1948). The incubation period at one Fosheim Peninsula nest was at least 515 hours, at most 520 hours (21.4 to 21.7 days). At two other nests the period was between 21 and 22 days. The incubation period of the Black Turnstone (*Arenaria melanocephala*) is stated to be 21 days (Brandt, 1943) or 21 to 22 days (Bent, 1929).

The female is on the eggs repeatedly, the male sporadically, throughout the incubation period. Jourdain (in Witherby, *et al.*, 1948) is correct in stating that incubation is done "chiefly by the female until near hatching," but it should be made clear that the male does not take over entirely before hatching. His urge to attend young increases at this time, and he visits the nest more often. The male parent at Nest 13 was killed early in the incubation period (June 20). The female alone cared for the eggs until they hatched on July 6; but the brood perished shortly thereafter, apparently from exposure, despite the fact that the female was still at the nest on July 7. At that time all four young were dead—three in the nest and one several feet away.

The only observation of broken-wing behaviour was at Nest 1, when the female parent flushed from underfoot, spread and dragged a wing, and fluttered off. The nest was eggless at the time. Otherwise the conspicuous Turnstones would always leave the nest long before we reached it. The bird on guard, usually the male, gave a loud warning. We never escaped notice while passing through nesting areas.

Throughout the egg-laying and incubation periods the Turnstones joined the Knots in low, circling flights over the tundra. It was first thought that these parties were composed of non-breeding birds, but single and paired birds were seen to leave the flock and return to nest areas. The largest mixed flock seen was one of seven Turnstones and 11 Knots.

Most Turnstone eggs under observation hatched July 4 to 5. The period of hatching, i.e., the time interval from hatching of the first young to hatching of the last, was 15.8 hours at one nest, about 11.5 hours at another, and less than 11 hours at another. The third egg (of four) at one nest was the third to hatch; in three nests the fourth hatched last. The hatching chick wriggles through a surprisingly small hole at the large end of the shell without help from either parent. The first parent that finds the empty shell immediately flies off with it.

Within a day the newly hatched chicks leave the nest. A 5-hour-old chick that ran from the nest remained in the nest when replaced; an 11.5-hour-old chick that ran from the same nest would not stay put when replaced. Chicks 15 hours old ran exceedingly well. At one nest the authors found and banded three chicks, returned eight hours and thirty minutes later, and found the banded chicks as well as the unbanded sibling in the nest—fair proof that chicks may return to the nest to be brooded.

The male parent was much stimulated by the peeping of young. During hatching he becomes aggressive and broody, and will, on occasion, even brood inanimate objects such as willow catkins that resemble downy young.

Except for a large downy chick caught near Eastwind Lake on July 10, the authors failed to find young Turnstones during the fledging period. This was due in part to the gathering of many Turnstone and Knot families in certain favoured areas. A number of these concentrations were noted on broad hummocky ridges a few miles north of Slidre Fiord and also in the vicinity of Eastwind Lake. Sim and Marsden reported having seen "literally dozens" of displaying Knots and Turnstones on a ridge 9 miles east of Slidre Fiord on July 12. Not all Knots and Turnstones

joined these aggregations of course, but many of them did. The gatherings probably took place in early July. Turnstones were absent in certain familiar places by July 7. By July 16 the authors were convinced that a general shifting of the population had taken place, for areas which had been alive with Turnstones now had none. Both Knots and Turnstones probably benefited by the combining of forces, for the noise and movements of so many adult birds were extremely distracting.

In 1951, Tener (Godfrey, 1953) saw young Turnstones "flying short distances" near Slidre Fiord July 24 to 25. Most young Turnstones probably fledged during this same period in 1955, but trips to other regions prevented the authors from witnessing the actual fledging on the Fosheim Peninsula. Young Turnstones that the authors saw on the northeast coast of Nansen Sound July 24 were flying. On July 27 the authors collected a bird of known age (22 days 6 hours) about two miles north of Slidre Fiord. It was the second chick banded at Nest 1 on July 5. Although fully fledged, it was still attended by an adult bird. Other Turnstones were near by. Some young birds flew in flocks. Adults were the last seen that day. No Turnstones of any age were seen in that particular area thereafter.

As late as July 30 the authors saw a pair of Turnstones (male collected), with at least two unfledged young. The family was by itself on a ridge not far from Slidre Fiord. One of the chicks was caught by hand after it had made several short flights, each of about 10 feet. This pair had nested late. This was the only evidence of a late Turnstone nesting.

Ideas differ as to which parent abandons the brood first. According to Manniche (in Bent, 1929) it is the male, but according to Salomonsen (1950-51) it is the female. In 1955 most adult Turnstones had left the Fosheim Peninsula by the time the young had moved out to the coasts. On July 30 only a few scattered Turnstones remained inland on the ridges north of Slidre Fiord. That day a male Turnstone (collected) alone defended three fully fledged young. These soon left, flying straight to the fiord.

It is difficult to say when parent Turnstones abandon their young. The banded juvenile collected July 27 (*see above*) was standing beside an unbanded juvenile when shot. Only one adult had defended them. Which chick belonged to the adult is not known. Conceivably, the adult was not the parent of either. In any event some Turnstone broods mix before adult-juvinal relations dissolve altogether. It can be validly stated that adult males defend fledged juveniles up to the time the young flock and go to the coast.

Departure. In 1955 the adult Turnstones simply faded away at the Fosheim Peninsula nesting grounds after the young left. They were never seen at the beaches during or following nesting, nor were they seen flocking before departure. No adult was seen anywhere after July 30 with one exception. A male by itself was collected far inland on a high plain south of Slidre Fiord on August 21. The bird ran and flew well and was exceedingly wary. Although there was no outward sign of injury, a lesion (regarded as mycosis by Animal Diseases Research Institute at Hull, Quebec) that existed in the lower viscera may in some way have prevented this bird from migrating.

As early as July 27 the authors saw young Turnstones flying in flocks directly toward Slidre Fiord. The largest flock of juveniles seen inland was one of 11 birds (July 30). Juveniles were first seen at the fiord shore July 29—flocks of four, nine, and three birds, and a single individual. From then until September they could be found alone or associating with other young shorebirds at the beaches, stony river deltas, or at the nearly dry stream-beds where they were often heard splashing in the shallow water.

Juveniles were common at Slidre Fiord in early August. The largest flocks (27 and 36 Turnstones each) were seen August 10. Migration was well underway by this time. Young Turnstones were still seen repeatedly in late August, but no more than four at one time. Two were seen September 1 but none thereafter. Bruggemann's (1953-54) latest date for young Turnstones at Slidre Fiord was September 3, 1953 (two birds). Feilden (1877) saw them on the north coast of Ellesmere Island as late as September 5 in 1875. In Greenland the young Turnstones start to migrate south from mid-August to mid-September, the majority of them before the end of August (Salomonsen, 1950-51).

Banding. On June 14, 1955, the authors collected a British-banded Turnstone (No. T3533) about three miles north of Slidre Fiord. The bird, a female, was shot near its eggs (Nest 6). According to Robert Spencer, Secretary of the Bird-Ringing Committee of the British Trust for Ornithology, this Turnstone was banded by H. G. Hurrell at Wembury, South Devon, England, on January 13, 1951.

The authors banded a number of Turnstones at Fosheim Peninsula in 1955. A male trapped and banded June 5 at Eureka was collected 1.5 miles from there in its nesting area on June 25. Two females that were banded at Eureka June 5 to 9 were not seen again. At nests 1, 2, 3, 4, 16, 18, and 20, the authors banded 26 downy chicks during July 4 to 5. At Nest 16 both parent birds were captured by hand and banded July 4; likewise, the male parent of Nest 18 was banded July 5. A large downy chick was caught by hand and banded July 10. All of these Turnstones were banded between Slidre Fiord and the north shore of Eastwind Lake.

The recovery of one Fosheim Peninsula juvenile is noteworthy. On September 11, 1955, Turnstone 502-75249, banded at Nest 1 on July 5, was killed at the mouth of the Cavado River between the villages of Fao and Esposende, Portugal. William Tait of Oporto, Portugal, reported its recovery. One of its three siblings, 502-75248, was the juvenile that the authors collected north of Slidre Fiord on July 27 when it was still attended by an adult (*see above*). Thus, 502-75249 must have flown from western Ellesmere Island across the Atlantic to Portugal in less than a 46-day period. More than likely it flew via Greenland and Iceland (*see Salomonsen, 1950-51*).

Courtship. According to Witherby, *et al.* (1948), the display and posturing of Turnstones is little known.¹ Ekblaw (in Bent, 1929) stated that the Turnstones begin mating as soon as they arrive in northwest Greenland and that courtship takes place within the first two weeks of

¹Details of their breeding cycle in Finland have been described by Göran Bergman 1946, *Acta Zoologica Fennica* 47. The authors did not know of this work at the time the present paper was written.

June. At Fosheim Peninsula the newly arrived Turnstones do not mate or even commence courtship immediately. They first go about singly or in flocks for several days. The actual courtship period is short—from June 3 to June 6 in 1955. In 1951 Tener (Godfrey, 1953) observed large flocks of Turnstones at Slidre Fiord until June 3, but smaller "courting groups" after that.

During courtship the bright males sparred and displayed on the ground before the females. Repeatedly the authors saw one bird dash at another, driving it off; or two birds facing each other with heads lowered, jabbing at each other with their bills. Males did not always fight. Frequently one crouched, lowered its head, lowered and rapidly vibrated its tail, and uttered metallic clinking notes which increased in tempo, ending in a rattle. Occasionally wings were lifted high. When these courting flocks were large (20 to 30 birds), the noise was continuous and loud.

Copulation was not part of the courtship itself. It was observed twice in 1955, both times during egg-laying in different nest areas. The female in each case simply crouched after being chased, permitting the male to mount from behind. Pursuit flights occurred even after egg-laying, but whether they were concerned with courtship is not clear. Two or three, sometimes four, individuals of both sex took part in the fracas. These erratic flights waned as the season advanced. None were noted after July 5.

Roosting. In late May and early June the Turnstones at Slidre Fiord roosted in flocks when the sun was low. With their heads turned back, they slept in snowless places near the fiord and along streams. The largest roosting flock seen was one of 48 Turnstones and two Knots (June 3, 11.00 p.m.). Most of these birds were asleep, but four or five of them, with an occasional change of individuals, kept watch. No group-roosting of adults was observed after nesting had started, but young birds roosted together in the dusk on the lee side of gravel bars at the fiord in August.

Food. In 1955 the newly arrived Turnstones at Slidre Fiord fed on vegetable matter. All five birds (three males, two females) collected there May 29 to June 1 were fat. Four had recently eaten grass seed; the stomach of one was empty.

Animal foods were also available. Areas of encrusted earth were common in the poorly vegetated, stoneless areas near the fiord. Immediately beneath the broken crust, the earth was fine grained and contained active moth larvae. Here, in snowless places, the Turnstones upturned the angular pieces that formed the crust, and fed on the insects. The birds did not flip the clods at random. In some places they turned many, in others few. Even during the stormy weather of May 31 (low air temperature 18.1°F.) the Turnstones busily flipped clods despite the blowing snow, which part of the time hid them from view.

As late as June 6, the Turnstones fed about the buildings at Eureka. They were not by any means the scavengers the Long-tailed Jaegers were, but the two species often fed side by side on kitchen scraps and on the flesh of a wolf carcass. The Turnstones were especially fond of dry oats.

With respect to adults collected in breeding areas, the stomach of a female contained four caterpillars and two spiders on June 14; those of five adults (both sexes) contained caterpillars only during June 17 to 25;

that of an adult male contained adult insects on July 30. Two female juveniles, collected inland on July 27 to 30, had eaten adult insects. An adult male, collected inland on August 21, had eaten one caterpillar and crane flies.

Predation. The Knots and Turnstones effectively combined forces against the Long-tailed Jaeger, probably the principal predator of these birds during the fledging period at Fosheim Peninsula. When several Jaegers attack an isolated family of Turnstones, the latter are likely to suffer. Both male and female Turnstones were given to chasing the Jaegers a long way, and sometimes they were gone long enough to permit other Jaegers to drop in and snatch an egg or chick. The Turnstone was never seen attacking a Jaeger that was standing on the ground, but the instant the Jaeger flew, the Turnstone went after it, striking it with its bill.

Two of 11 Turnstone nests under observation were destroyed by predators. On June 10 the scattered feather and bone remains of an adult were found.

Specimens. Ten adult males [weight 95.2 to 126.0 gm (av. of nine 110.6), wing chord 138.0 to 152.0 mm (146.8), tail 57.5 to 67.0 (63.1), exposed culmen 19.5 to 23.0 (av. of nine 21.0), tarsus 24.0 to 26.0 (24.7)] and nine adult females [weight 101.0 to 132.0 (115.6), wing chord 148.0 to 157.0 (151.4), tail 61.5 to 66.5 (63.6), exposed culmen 20.0 to 22.5 (21.2), tarsus 24.5 to 28.0 (25.6)] were collected at Fosheim Peninsula from May 29 to July 30 (one male collected August 21) in 1955.

The average wing-length of five adult males from the north coast (Alert) measured by Godfrey (1953) is 147.0 mm, of seven adult Fosheim Peninsula males, 147.0; of four adult females from both areas, 150.9. These averages fall so close to those of the 1955 birds that they probably portray unbiased averages for Ellesmere Island birds as a whole. The wing-length of these birds is shorter than expected for the nominate race. This suggests that the New World race *A. i. morinella* may influence Ellesmere Island population. On the other hand, the small size parallels the peculiar situation found in Ringed Plovers. The population of Plovers breeding at high latitudes is somewhat smaller than the population breeding farther south, an apparent reversal of Bergmann's Rule. Salomonsen (1950-51), however, states that this phenomenon is better explained by considering the wintering grounds for those Plovers that breed farther north and winter farther south in warmer climate.

Other than wing-length and egg size (see below) there is no apparent tendency of Ellesmere Island Turnstones toward *morinella*, the streaking on head and colour of the dorsum, especially, being typical of the nominate race. Even tail-length falls within the range of *interpres* (see Ridgway, 1919, and Salomonsen, 1950-51). Banding returns, referred to above, are fair proof that both young and old Fosheim Peninsula birds winter in the Old World.

An adult male and female collected June 22 to 23 showed traces of moult on the head and neck, but no adults collected or observed thereafter showed any real moult. The diseased adult collected August 21 was not moulting. The authors conclude that the postnuptial moult does not take place at Fosheim Peninsula breeding grounds.

Several immature Turnstones were collected at Fosheim Peninsula in 1955. An unfledged female juvenile (age not known, weight 86.0, wing chord 105.0, tail 28.5, exposed culmen 19.0, tarsus 24.5) collected July 30 has natal down in the region of the forehead, nape, throat, mid-chest, lower belly, and thighs. A fledged female (age 22 days 6 hours, weight 98.0, wing chord 132.0, tail 50.5, exposed culmen 20.0, tarsus 24.0) collected July 27, had considerable natal down on the head, but most of this came off during preparation as a skin. A well-developed male juvenile (age not known, weight 108.1, wing chord 149.0, tail 63.0, exposed culmen 21.0, tarsus 25.5), collected August 17, had no traces of down. With respect to colour, these birds appear to be typically *interpres*. A series of 17 other Ellesmere Island immatures (discussed by Godfrey, 1953) are likewise *interpres*.

Three downy chicks [two females, sex of one uncertain; weight 10.5 to 12.5 (11.2), exposed culmen 10.5 each, tarsus 19.0 to 20.5 (19.8)] were less than one day old when collected at Fosheim Peninsula July 4 to 7, 1955. The underside of these chicks is white except for the chest, which is covered with dark down tipped with white, appearing as diffused grey. Thus, the chest band is already present in the nestling. The statement in Bent (1929) describing the underparts as "pure white" is incorrect. The Fosheim Peninsula downies do not differ greatly from Southampton Island downies,¹ but the former are less buffy above.

Five 4-egg clutches and a single egg [length 39.5 to 44.0 mm (41.35), width 28.0 to 30.5 (29.5)] were collected at Fosheim Peninsula in 1955. These 21 eggs appear larger than those of a smaller series of two 4-egg clutches and two eggs of *A. i. morinella* [length of nine (one broken) 38.0 to 42.0 (39.67), width of ten 27.0 to 28.5 (27.9)] from Baffin and Victoria islands.² When compared statistically (Fisher's *t*), however, there is no significant differences (length: $t = .023$, width: $t = .032$, although the clutch-sampling introduces some bias. One hundred eggs collected in Europe and measured by Jourdain (in Bent, 1929) averaged 40.5 by 29.2. Brandt's (in Bent, 1929) 44 Alaskan eggs averaged 39.0 by 28.0.

Pleske (1928) states that Turnstone eggs are coloured in two ways. In the common type the ground colour is almost hidden by thick superficial spots. In the uncommon type the ground colour predominates. One Fosheim Peninsula set is of the first type, another of the second type. In each of three sets, three of the eggs are of the second type and one is of the first type.

Annual breeding cycle. In late May, before the spring thaw sets in, a few Turnstones of both sexes appear on the Fosheim Peninsula. About June 1, many Turnstones arrive. Courting groups start to form about June 3, courtship culminating about June 5. Pairs form and go inland to well-vegetated breeding grounds. The first eggs are laid about June 10. The pairs tolerate one another, and also the Knots, during and after egg-laying. An egg is laid each day, four being the clutch. The female incubates regularly, the male sporadically. The incubation period is 21 to 22 days. The hatching period of the whole brood is rapid, being much less than a

¹Specimens at Carnegie Museum, Pittsburgh.

²Specimens at National Museum of Canada.

day. Young leave the nest within a day of hatching. After hatching, many Turnstones abandon their nest areas and join forces with Knots in certain favoured areas. Fledging requires about 19 days. Both parents remain with the young during fledging, but females leave the nesting areas before the males and fledged young. At one nest, 48 days elapsed from the laying of the first egg to the departure of the brood for the coast. The flying young go to the beaches in late July and early August. The last adults leave the peninsula at this time. The young are numerous at the river mouths and along the fiord shores during the first ten days of August, but they become increasingly scarce thereafter. By early September the last of them have left for the Old World wintering grounds.

The annual routine of *A. i. interpres* on Ellesmere Island is the more interesting when compared with that of *A. i. morinella* on Southampton Island, nearly a thousand miles to the south. That form arrives on its breeding grounds later than *A. i. interpres* does at Fosheim Peninsula. The chicks hatch about July 15 (9 to 11 days later than at Fosheim Peninsula), and in late July the adults begin their postnuptial moult "which is apparently completed before they migrate" (Sutton, 1932).

***Calidris canutus* (Linnaeus) Knot**

The Knot has been a common summer resident of the Fosheim Peninsula. In 1955 it was common there, but less so than the Turnstone and Snow Bunting. It was found almost everywhere. In certain areas it was the most abundant and conspicuous bird. Fosheim Peninsula Knots belong to the nominate race *Calidris canutus canutus*.

Sim and Marsden noted two adult and 14 fledged young Knots in the Caledonian Bay area of Canyon Fiord east of the Fosheim Peninsula on July 26, 1955. At 80°46'N., 88°23'40"W. on the northeast coast of Nansen Sound, the authors noted an adult with three fledged young on July 24, 1955.

In Axel Heiberg Island, at 80°12'N., 87°54'W. on the Schei Peninsula, the authors noted one adult Knot on July 25, 1955.

Arrival. Records (Feilden, 1877; Greely, 1886; MacDonald, 1953) indicate that the Knot arrives in northern Ellesmere Island in late May and early June—the same time that it does in northern Greenland (Salomonsen, 1950–51). Arrivals at Slidre Fiord fall within this same period. In 1951 Tener (Godfrey, 1953) first noted it there on May 27 (one bird); he saw more than 75 on June 3. Bruggemann (1953–54) first noted it there in 1953 on May 27 (flock of 12); in 1954, June 1 (three birds).

In 1955 the authors first saw the Knot on May 30. There were many Knots that day at Slidre Fiord. The birds were not paired. They were going about in flocks as well as separately. Some flocks were composed of Knots and Turnstones, but the two species had arrived separately. Everywhere the clear mating calls of the Knot sounded. From slopes still covered with snow, the earliest arrivals rose to great heights in giving their display flights, singing as they circled, then plunging to the earth and remaining silent.

The two sexes arrived together. On June 1 the authors collected five males and eight females from a flock of about 80 birds. The gonads of all the specimens were enlarged. The largest testis of the series measured 13.0 by 8.5 mm, the largest ovum 6.0.

Migrating Knots were last seen in spring that year on June 2—a flock of 60 birds flying near Eureka. The newly arrived Knots did not frequent the fiord beach as did the Turnstones; and unlike the Turnstones, they did not visit the Eureka station grounds. They went quickly to the inland breeding areas, which were then mostly covered with snow.

Nesting. Records (Feilden, 1877; Greely, 1886; Bay, in Sverdrup, 1904; Bent, 1927, Schaanning, 1933; MacDonald, 1953) indicate that the Knot breeds extensively in Ellesmere Island. Most of these records are of adults in breeding areas or of small young, but not of nests. At Cape Sheridan, Peary (Bent, 1927) found two Knot nests—the first recorded in the New World—on June 26 and 27, 1909; however, most Ellesmere Island nests have been found on the Fosheim Peninsula. Near Slidre Fiord in 1951, Tener (Godfrey, 1953) observed two nests—one with four eggs on June 23, another with newly hatched young on July 12. In 1953 a nest with “eggs” was found a few yards from the Eureka airstrip about June 12 (Bruggemann, 1953-54).

Tener (Godfrey, 1953) believed that the nesting habitat of the Knot on the Fosheim Peninsula was weathered sandstone ridges and elevations with scattered clumps of willow, dryas, and poppy. In 1955 the species was seen in many sorts of places; but most pairs, nests, and small young were found inland below 600 feet elevation in well-vegetated tundra. Few Knots inhabited the dry, easily traversed slopes and ridges. No nests were found on stony or gravelly ground as described by Salomonsen (1950-51); nor were any of them found in scree, as was that photographed by Peary at Cape Sheridan (see Bent, 1927: plates 24, 25). The favoured Fosheim Peninsula nesting ground was wet while the eggs were in the nest. So wet were some areas that the authors sank in water and mud half-way to their knees near one nest—hardly two inches above water on a hummock! The wet areas gradually dried as the season advanced.

The Knots were puzzling. They did not defend nesting areas against humans, in this respect being different from the Turnstones with whom they associated freely. When flushed, they flew long distances, often disappearing altogether. When watched from afar, they fed and walked about aimlessly, eventually flying out of sight. And the fact that Knots continued to fly about in flocks after June 15 was disquieting. So strikingly different was their behaviour from that of Turnstones that the authors were nearly convinced that they were not nesting. However, a female with brood patches was collected on June 19, and several days later a nest was found. Having learned that the Knots were nesting, not merely feeding, in areas obviously favoured by them, the authors found several nests—nine in all.

All nine nests were slight hollows lined with willow twigs, dry leaves, grasses, occasionally bits of moss. All were in low spreading vegetation on more or less hummocky ground. The elevation of six nests was recorded (lowest 281 feet, highest 757, average 463). Elevation of the other three

nests was estimated at 400, 425, and 1,100 feet. One nest was only half a mile, others from one to 8 miles, from the fiord. Two nests were within half a mile of each other; others were from one to 10 miles apart. Data concerning the nests are:

Nest No.	Date found	Contents when found	Clutch size	No. young hatched	Date of hatching
1	June 21	eggs 4	4	collected June 21	—
2	22	4	4	3	July 3-5
3	24	4	4	collected June 26	—
4	25	4	4	collected June 26	—
5	27	1	—	0 (nest destroyed)	—
6	July 3	4	4	3	5-6
7	3	4	4	—	—
8	10	3 young, 1 egg	4	3, possibly 4	10
9	12	4	4	4	12-13

The eggs of Nests 1 and 4 contained small embryos. One egg of Nest 2 did not contain an embryo. Three eggs of Nest 3 contained large embryos, but one egg had no embryo.

The Knot incubated closely. One incubating individual was even captured by hand and banded. When flushed from the nest, the species almost invariably uttered low peeping cries and feigned injury. Half running, with tail spread and dragging, and with rump plumage, scapulars, and body feathers elevated, it propelled itself to some extent with downward thrusts of its wings. Returning to normal, it flew off, only to return a moment later and go through the whole procedure again. One led the authors thus a full mile; another discontinued its injury-feigning when about a hundred yards from the nest. When the Knots finally flew off, they flew far and remained away an incredibly long time. Even during the near-freezing weather of July 6, the pair at Nest 6 did not return to their four pipped eggs for several hours. One of this brood died then.

The incubating Knot collected at Nest 4 was a male; however, specimens of both sexes had brood patches. Change-over at the nest was not observed. Only once did the authors actually see a Knot return to its eggs.

Companies of up to 30 Knots frequently engaged in aerial manoeuvres over the nesting grounds. Turnstones often joined in these manoeuvres. The performers circled widely, disappearing and reappearing, usually staying about 100 feet above the ground. The circling was most noticeable in late June and early July. The flying flocks were first thought to be composed of non-breeding birds, but it was discovered that certain individuals continued to leave the group while others joined it. The authors became aware of this, partly through watching the Turnstones, which, unlike the Knots, usually returned directly to their nesting spots. While watching the circling of six Knots on July 3, the authors saw the company suddenly break up into three pairs. Each pair flew off in a different direction.

Recently hatched chicks out of the nest were first noted on July 6. The authors found two broods of three chicks each (one chick collected, five banded). Sim and Marsden noted another brood of three. Allowing 21 to 22 days for incubation (Salomonsen, 1950-51) of eggs, from which these chicks hatched, egg-laying probably started about June 10 or 11.

On July 9 the authors found two broods and banded five of six chicks seen. The chicks, though downy, were obviously larger than those found on July 6. A very small, recently killed chick found on July 11 was certainly of a late nesting. Three fairly large downies (weight approximately 50 gm) were captured together on July 15 and banded. They were attended by three adults and probably belonged to more than one brood. A well-developed chick was captured July 18 and banded. Of two well-developed chicks seen on July 20, one was captured and banded.

Some chicks were nearly able to fly by July 22. Three chicks (probably not siblings), captured that day and banded, appeared to be capable of flight; but when released and chased, they ran off instead of flying. All of these young Knots were seen on the peninsula north of Slidre Fiord. Except for one brood (July 6) at 870 feet, all of them were seen at elevations below 600 feet. In 1951, Tener (Godfrey, 1953) saw young Knots flying "short distances" near Slidre Fiord on July 23.

None of the banded young Knots was recovered, and the authors failed to ascertain precisely the period of fledging. It probably is close to 18 days. Young Knots that the authors saw that year, on the northeast coast of Nansen Sound were flying strongly on July 24. Most young Fosheim Peninsula Knots fledged in late July. No small chicks were noted anywhere on the peninsula at that time. Downy chicks have been found in Greenland throughout most of July (Salomonsen, 1950-51) and on the north coast of Ellesmere Island as late as July 30 (Feilden, 1877) and July 26 (MacDonald, 1953).

Both sexes cared for the young, but it was difficult to be sure which one was more attentive when the chicks were small. Not only were the sexes similar, but more often than not, one of the pair was away while the other attended the brood. This problem was the more complicated when many Knot and Turnstone families gathered in certain favoured areas. These mixed flocks gathered in early July and were conspicuous by mid-July. They lasted until the families broke up and left the nesting areas. The Knots were often so concentrated during the fledging period, that a number of them customarily feigned injury at once.

Ideas differ as to which parent abandons the brood first. Manniche (1910) thought that care of young was "entrusted to the female alone." According to the authors' experience, males attended the young up to the time the broods flocked and went to the fiord shore. By July 30 most adult Knots had left the nesting grounds, but a few scattered individuals with broods remained. Of three that were seen feigning injury that day, all were males (collected). The authors last noted an adult Knot and young (three newly fledged birds) together on August 5. The parent (collected) was a male. When the females left the family groups and nesting grounds is uncertain.

Departure. Adult Knots were not seen anywhere along the beaches after their departure from the nesting grounds in 1955. None were seen inland after August 5, but Duvall and Handley (1948) saw one north of Slidre Fiord as late as August 9 in 1947. The latest record for an adult Knot on the Greenland breeding ground is August 8 (Salomonsen, 1950-51).

In Greenland most young Knots migrate in mid-August, but some remain into early September (Salomonsen, 1950-51). In Ellesmere Island young Knots have been noted on the north coast (MacDonald, 1953) and on the east coast (Feilden, 1877) as late as August 25, in 1951 and 1875 respectively. At Slidre Fiord in 1953, Bruggemann (1953-54) saw the species in September—nine birds on the 3rd and one on the 8th. In 1954 he did not record any of the species after July 24.

In 1955 the young Knots made their way from the nesting areas to the fiord shore in late July and August. They were first seen at the fiord on July 29 (flock of five flying); inland they were not seen after August 5. At the beach they associated with other young shore-birds until departure. Most young Knots had left Slidre Fiord by mid-August, but a few remained to the end of the month. The last one seen was with a Turnstone near Eureka on August 31.

Roosting. In early June of 1955, Knots were seen roosting on several occasions. Like the Turnstones they slept in snowless places, usually along streams, when the sun was low. Several active birds kept watch for the flock. The authors never saw them sleeping with their heads turned back. They faced straight ahead with necks drawn in, assuming a plump, rather dumpy appearance. On one occasion two Knots roosted with 48 Turnstones. On the nesting grounds they did not roost in flocks, nor did they seem to have a specific roosting period.

Voice. The mating call of the male has been described by many who have heard it. To the authors it was merely *poor-me*, with the emphasis being either on the "poor" or "me."

The "poor-me" call was given less frequently as the season advanced. A common flight call during incubation was a rapidly repeated *whip-poo-me*, the significance of which was not understood.

The warning calls of the parent Knot—*whit-whit*, *whit-whit-whit*, sometimes *wit-wit* or *wheat-wheat*—were effective throughout the period of fledging. These calls, given in flight or on the ground, invariably stopped a chick in its tracks. There was no scampering, not the slightest movement of the chick until it was touched. Then it ran off peeping loudly.

Food. It is well known that the Knot can subsist on vegetable foods, especially in spring on the breeding ground (Feilden, 1877; Manniche, 1910; Salomonsen, 1950-51). At Fosheim Peninsula in the spring of 1955, the Knots found an ample supply of grass shoots, seeds, and other plant items in the thin snow-cover. Of 13 specimens (both sexes) collected on June 1, all but one had recently eaten plant food, none of them animal food. A male collected June 10 had also eaten vegetable matter only.

The diet changed as the season advanced. A female collected June 19 had eaten 51 caterpillars and no plant food. A male collected June 21 had eaten three caterpillars only. An adult male collected July 23 and

three adult males collected July 30 had eaten adult insects only. A young male and young female collected July 30 had eaten adult insects, including craneflies. An adult male collected August 5 had eaten both seeds and adult insects. A young male collected August 17 had eaten adult insects and marine invertebrates.

Predation. Problems of predation and survival were much the same for the Knot as for the Turnstone. The two species occupied the same habitat, nested in similar places, and raised their young together.

The Knot was most vulnerable between hatching time and fledging time, for during this period its principal predator—the Long-tailed Jaeger—was quartering the tundra almost constantly. These predators were attracted from afar by the peeping whenever the authors captured young Knots. When several Jaegers converge on a single family of Knots, some of the chicks are likely to be caught. The Knots, like the Turnstones, are capable of driving off the Jaegers, but in doing so they often chase the Jaegers far and expose their young to other Jaegers. In this respect there is a real advantage in concentrating numbers against predators, and indeed this is the case with the remarkable Knot-Turnstone concentrations that form after the young hatch. It is not difficult to imagine how selection operates in the evolution of such an effective defensive behaviour.

A Jaeger carried off a large but flightless Knot chick (weight 50.2 gm) within a few feet of the authors. No Jaegers, however, were seen attacking fledged Knots.

Specimens. All 13 adult males [weight 112.2 to 135.5 gm (av. 125.5), wing chord 154.0 to 168.0 mm (161.0), exposed culmen 30.0 to 33.0 (31.5)] and nine adult females [weight 135.4 to 169.0 (147.9), wing chord 161.0 to 172.0 (165.7), exposed culmen 32.0 to 36.0 (33.2)] collected at Fosheim Peninsula from June 1 to August 5, 1955, are dark above and below, and the rufous of the underparts, especially of males, extends far down on the abdomen. They do not differ greatly from a smaller Ellesmere Island series (Alert and Slidre Fiord) already discussed by Godfrey (1953). The authors agree with Godfrey and refer all of these Ellesmere Island Knots to the nominate race.

Both sexes of Knot arrived at the Fosheim Peninsula breeding grounds in nuptial plumage (acquired earlier by an incomplete moult). Some winter feathers, excluding those normally retained, were found on all the birds handled. Grey winter feathers were particularly noticeable on the breasts. The authors looked carefully for a postnuptial moult but concluded that this was hardly started on the nesting grounds. Except for a thin scattering of pinfeathers, none of the male specimens (no female was collected after June 19) collected in late July was moulting. The male collected on August 5 had more pinfeathers on the belly and neck and was noticeably greyer about the head and neck. By that time most adult Knots had left the peninsula.

The immature birds collected at Fosheim Peninsula in 1955 differ in colour (buffiness) of the underparts. A male (weight 107.6, wing chord 150.0) and female (weight 117.1, wing chord 145.0) collected on July 30 are noticeably less buffy than a male (weight 94.5, wing chord 147.0) collected August 6, and a male (weight 122.3, wing chord 149.0) collected

August 17. The August 6 specimen is downy about the base of the bill, while those taken a week earlier are comparatively free of down. This colour difference would thus appear to be dichromatic.

Four small downies collected at Fosheim Peninsula in 1955 closely resemble two downies from Alert (see Godfrey, 1953). All six Ellesmere Island downies (*C. c. canutus*) can be easily separated from four small eastern Victoria Island downies (*C. c. rufa*)¹ that are greyer, less buffy, in colour. Even considering the small sample, this difference in colour appears to be racial rather than dichromatic.

A large downy chick (weight 50.2, wing chord 53.0) collected at Fosheim Peninsula on July 15, 1955, had feathers appearing on the wings, back (not rump), and sides.

Knot eggs observed at Fosheim Peninsula in 1955 varied considerably in size, shape, and marking, but the ground colour of all was green. Commonly, the eggs were boldly marked with light to dark brown splashings and dabs of lavender. The markings were often whorled and heaviest at the large end. Some eggs were much less boldly marked and lacked the dark brown spots.

Three sets (four eggs each) and a single egg (abandoned at nest) were preserved. The sets average 42.1 by 31.8 mm, 42.6 by 29.8, and 42.2 by 30.0, respectively. The single egg measures 40.0 by 29.5. All 13 eggs measure: length 40.0 to 43.5 (av. 42.2), width 29.5 to 32.0 (30.5). Although these eggs were not exposed to light, the green ground colour of all faded somewhat within the first four months. There has been no pronounced fading since.

Annual breeding cycle. Flocks of Knots arrive at Fosheim Peninsula in late May or early June. The period of arrival is short. The sexes arrive together and immediately scatter widely on the inland nesting areas. Courtship flights are continuous and pairs form. A favoured habitat is well-vegetated hummocky tundra. Egg-laying culminates in mid-June and continues into late June, exceptionally later. The clutch size is four, probably sometimes three. Both sexes incubate. Hatching culminates in early July and continues into mid-July, exceptionally later. Knot and Turnstone families band together in large numbers during the fledging period. Females leave the broods first. Most chicks fledge in late July, nearly all by August. Males remain with the broods until the young form flocks and abandon the nesting areas for the seashore. Extensive postnuptial moulting does not take place on the nesting grounds. Most adults leave the peninsula in July, nearly all by August. Males with late broods remain longer. Most young leave by mid-August, but a few remain at the beaches into early September.

***Erolia bairdii* (Coues) Baird's Sandpiper**

Heretofore Baird's Sandpiper has not been reported from the Fosheim Peninsula where it nests, probably in small numbers. In 1955 it was seen there on two occasions only.

¹Specimens at National Museum of Canada.

In Axel Heiberg Island at 80°42'40"N., 90°59'W. (18 miles northwest of the mouth of Stang Bay and 3 miles from the coast), in high, well-vegetated country, the authors collected an adult male Baird's Sandpiper (testis 2.0 mm) with distinct brood patches on July 23, 1955. The bird behaved as if young were close by, but no chicks were seen.

Nesting. In the Canadian Arctic Archipelago, Baird's Sandpiper breeds as far north as the northern shore of Lake Hazen, 81°49'N. (Tener, 1958, in litt.), but its distribution at high latitudes is not well known. Specimens (adult, Hayes Sound, July, 1899; clutch of four eggs, "Stordalen," June 20, 1900) collected in southern Ellesmere Island by the Second *Fram* Expedition have been reported by Schaanning (1933). At least one pair nested on the Fosheim Peninsula in 1955. In well-vegetated hummocky tundra just south of Eastwind Lake on July 15, the authors collected an adult and two of its three large but flightless chicks. The parent bird, a female, had distinct brood patches. A second adult ran and flew about excitedly in the same area, finally flying off.

Baird's Sandpiper may breed abundantly at one particular place and be entirely absent at "equally suitable" places close by (Dixon, 1917). This species may have been largely overlooked on the Fosheim Peninsula, but granting that, it was certainly the rarest scolopacid encountered by the authors in 1955.

Departure. Baird's Sandpiper was not seen among the various young shorebirds at the fiord beach in August. The authors did, however, collect two young birds in a creek bed near Slidre Fiord on August 27.

Specimens. The adult male (weight 34.5 gm, wing chord 116.0 mm) collected in Axel Heiberg Island on July 23, 1955, was moulting heavily. An adult male collected on the east coast of Baffin Island on July 10, 1950, had brood patches and was beginning to moult (Wynne-Edwards, 1952).

The adult female (weight 45.8, wing chord 121.0) collected on the Fosheim Peninsula on July 15, 1955, was moulting heavily. Although its two chicks (females: weight 21.0 and 21.9, exposed culmen 14.0 each, tarsus 21.0 each) were mostly covered with down, their remiges were bursting from their sheaths as were feathers on the back, scapulars, sides, and flanks.

The two young birds collected August 27, 1955, near Slidre Fiord were well developed (male: weight 36.2, wing chord 119.0, exposed culmen 21.0, tarsus 22.0; female: weight 36.1, wing chord 121.0, exposed culmen 21.5, tarsus 21.0).

Annual breeding cycle. There is no spring record for Baird's Sandpiper on the Fosheim Peninsula. Large chicks found July 15 indicate fairly early egg-laying, conceivably as early as mid-June. Both sexes have brood patches. The female and probably the male attend young. Postnuptial moult is well under way on the breeding grounds by mid-July, but this moult may or may not be completed there. Young birds have been seen on the peninsula as late as August 27.

***Crocethia alba* (Pallas) Sanderling**

The Sanderling has been a rare summer resident on the Fosheim Peninsula. In 1955 it was encountered several times inland where it nested. It was seen most often in late summer when the young frequented the fiord beaches.

Arrivals. Knowing that Sanderlings in northeast Greenland arrive in company with other waders and flocks of Snow Buntings (Manniche, 1910), the authors looked carefully for Sanderlings among the various early flocks that arrived at Slidre Fiord, but failed to find them. In 1949, at ponds near Slidre Fiord, Hatfield (in Handley, unpub. MS.) saw flocks of small "waders" with reddish breasts and backs, probably Sanderlings, but he recorded no dates. Neither Tener (Godfrey, 1953) nor Bruggemann (1953-54) recorded the arrival date of the species at Fosheim Peninsula.

Nesting. In northern Ellesmere Island, in Grinnell Land at 82°33'N., Feilden (1877) found a Sanderling's nest with two eggs on June 24, 1876. In 1958 Tener (in litt.) observed an adult with four small young at north end of Lake Hazen at 81°49'N., 71°18'W. MacDonald (1953) thought that the species nested in the Alert area in 1951. Greely (1886) did not with certainty record it on the east coast, and Bay (in Sverdrup, 1904) did not record it at all in southern Ellesmere Island. On the Fosheim Peninsula, in the Slidre Fiord area, Tener (Godfrey, 1953) saw an adult Sanderling with three very small young on July 12, 1951. Near Eastwind Lake on July 23, 1953, Bruggemann (1953-54) saw an adult Sanderling behave as if a nest or young were close by. He did not record the species at all in 1954.

The first Sanderlings noted in 1955 were near Eastwind Lake. There, during June 29-30, several were seen flying with larger numbers of Knots and Turnstones. Sanderlings were next seen there on July 2—a flock of three flying. None of these Sanderlings showed attachment to any particular area.

The only Sanderling nest found by the authors in 1955 was discovered July 12 on dry, stony ground west of Eastwind Lake where plants were widely scattered. The nest, a slight hollow lined with dry willow leaves, was in a patch of *Dryas*. It held four eggs. The site was at 740 feet elevation, above the wet, well-vegetated marsh and hummocky areas where the species had previously been seen flying and where Knots and Turnstones were conspicuous throughout. Eleven Greenland nests found by Manniche (1910) were in or near *Dryas* on a dry, clay-mixed, stony plain sparsely covered with vegetation.

When discovered (7.15 p.m.), two of the eggs were pipped. All four eggs were pipped by 7.30 the following morning (July 13). When last checked (8.15 a.m., July 15) the bills of the young were not yet protruding from the eggs. Only *one* adult was in attendance during this time. The authors knew it was the same individual, visit after visit, not only by the very pale breast and upper parts—strongly suggesting a female (see Witherby, *et al.*, 1948, 4:280)—but also by an injured toe nail on the right foot.

Allowing 23 to 24 days for incubation (Manniche, 1910), egg-laying must have been completed by about June 19 at one Fosheim Peninsula nest in 1951, since Tener (*see above*) found small young on July 12 of that year. Egg-laying probably was completed about June 22 at the Eastwind Lake nest in 1955.

Adult Sanderlings were noted at several places other than the Eastwind Lake area. Sim and Marsden saw one in the vicinity of Iceberg Point on July 2, but the bird did not behave as if nesting. However, one seen July 18, on a high stony ridge near the head of Slidre Fiord, behaved as if young were close by. It circled erratically, occasionally flying out of sight, but always returned a few minutes later. Failing to find the chicks, the authors collected it—a bright male (largest testis 4.0 by 3.0 mm; stomach: one adult crane fly), with well-defined brood patches.

Not all ornithologists agree as to which sex incubates. According to Jourdain (in Witherby, *et al.*, 1948) there is no brood patch in male Sanderlings, a point of view not held by Manning, *et al.* (1956). Manniche (1910), inferring that females do all the incubating, states that the males form flocks (when incubation begins) and leave the breeding grounds before the middle of July. On the other hand, the Sanderling shot at the nest by Feilden (1877) was a male. Probably both sexes incubate, but it appears that one or the other parent at a given nest deserts at some point in the cycle.

Departure. In Greenland, autumn migration of adult Sanderlings takes place from late July to mid-August, and of young Sanderlings from the latter half of August to mid-September (Salomonsen, 1950–51). Departure of adult Sanderlings from Fosheim Peninsula is not known, the latest date for an adult being July 23 (Bruggemann, 1953–54). Fledged juveniles, however, occur fairly regularly at the fiord beaches. There they often accompany young Knots and Turnstones. In 1955 young Sanderlings were noted occasionally at Slidre Fiord during August 3 to 31, usually one to five individuals with other shore birds. The largest flocks of Sanderlings noted were one of nine (August 17) and one of seven (August 22). The authors failed to note the species after August 31, but Bruggemann (1953–54), in 1953, recorded it at Slidre Fiord in mid-September. His observation is noteworthy. Two young Sanderlings fed with Snow Buntings at Eureka during September 13 to 16, when the ground was snow-covered and the air temperature below freezing. They hopped about on one foot, feeding halfheartedly on kitchen refuse which included corn-meal and crackers.

On the north coast of Ellesmere Island in 1951, MacDonald (1953) last saw young Sanderlings on September 3 (two birds).

Specimens. One adult male (weight 50.3 gm, wing chord 119.0 mm, exposed culmen 23.5, tarsus 23.0) collected at Fosheim Peninsula July 18, 1955, had started its postnuptial moult of the body plumage.

Two immature males (weight 44.4 to 54.6, wing chord 111.0 to 116.0, exposed culmen 20.0 to 23.0, tarsus 24.5 to 25.0) were collected in 1955 at Fosheim Peninsula on August 3 and 17, respectively. Three immature females (weight 54.6 to 51.0 to 51.3, wing chord 115.0 to 120.0 to 124.0,

exposed culmen 23.0 to 25.0 to 25.0, tarsus 23.0 to 25.0 to 25.0) were collected in 1955 at Fosheim Peninsula on August 3, 26, and 31, respectively. The flight feathers of the August 3 specimens were still partially sheathed and not full length.

Annual breeding cycle. Nothing is known of the arrival of Sanderlings at Fosheim Peninsula. The few birds that probably breed there are well scattered. The favoured nesting grounds are dry, sparsely-vegetated areas. Egg-laying starts in mid-June, hatching in mid-July. One Fosheim Peninsula bird, probably a female, was the only parent that incubated pipped eggs during July 12 to 15. Some males have brood patches and attend young. Postnuptial moult of body plumage in males starts as early as mid-July. Nothing is known of the departure of adults from the Fosheim Peninsula breeding grounds. Young Sanderlings occur at the fiord beaches during August. Some have been noted there as late as mid-September, but this is exceptional.

Phalaropus fulicarius (Linnaeus) Red Phalarope

Heretofore the Red Phalarope has not been reported from the Fosheim Peninsula. In 1955 it was noted there on three occasions.

Arrival. The Red Phalarope arrives in Greenland June 9 to 13, later than any other bird (Salomonsen, 1950-51). On the north coast of Ellesmere Island, MacDonald (1953) collected three males and six females from a flock of ten birds on June 23, 1951. In northeastern Fosheim Peninsula in 1955, Sim and Marsden saw a single individual far inland on June 18.

Nesting. According to Hellmayr and Conover (1948) the Red Phalarope breeds northward in Canada to northern Ellesmere Island. In 1876 Feilden (1877) collected a female on the north coast on June 30, and in July he saw there a pair that was "apparently breeding." Although no eggs or young were found on the Fosheim Peninsula in 1955, the species probably bred there in small numbers. On July 2, Sim and Marsden noted six individuals at a lake near Iceberg Point where, on July 11, the authors collected a single male with distinct brood patches at one of several sedgy ponds. The bird had flown about erratically as if eggs or young were close by. It was not moulting.

Elsewhere, the authors failed to find the species at any of many marshy ponds visited in 1955 in the Fosheim Peninsula interior. Had it been at all common in 1953-54, Bruggemann would have surely noted it.

Specimens. A single male (wing chord 125.0 mm, exposed culmen 22.0, tarsus 20.5) was collected at Fosheim Peninsula on July 11, 1955. This bird has slightly darker dorsal feather edgings than two males from the north coast (Cape Belknap, June 23, 1951); however, a third male from Cape Belknap (same date) is the darkest bird of all. Manning, *et al.* (1956) found that the Cape Belknap birds, including six females, averaged paler than Baffin Island birds that were taken at the height of migration before courtship and feather wear. Whether Ellesmere Island phalaropes belong to the little-recognized, pale Spitsbergen race *P. f. jourdaini* is uncertain; but they may well arrive from the Old World.

***Stercorarius longicaudus* Vieillot Long-tailed Jaeger**

The Long-tailed Jaeger has been common on the Fosheim Peninsula, all observers since 1947 having seen much of it. In 1955 it was common there, only the Turnstone, Knot, and Snow Bunting being commoner. It was widely dispersed and conspicuous, especially along the coast and in well-vegetated areas inland. Sim and Marsden saw several in the Caledonian Bay area of Canyon Fiord east of the Fosheim Peninsula during July 23 to 27, 1955. On July 24, 1955, at 80°46'N., 88°23'40"W. on the northeast coast of Nansen Sound, the authors saw a pair behave as if small young were close by.

A pair of Long-tailed Jaegers that the authors noted at 80°12'N., 87°54'W., on the Schei Peninsula, Axel Heiberg Island, July 25, 1955, behaved as if they had small young close by.

Arrival. The Long-tailed Jaeger arrives in high-arctic Greenland in late May and early June (Salomonsen, 1950-51). In Ellesmere Island, both Feilden (1877) and MacDonald (1953) recorded its arrival on the north coast during the first week of June in 1876 and in 1951 respectively. On the east coast, in 1882, 1883, and 1884, Greely (1886) noted its arrival on June 3, June 4, and May 23, respectively.

In 1951 Tener (Godfrey, 1953) first saw the species at Slidre Fiord on June 7 (one bird). In 1953 and 1954 Bruggemann (1953-54) first observed it at the fiord on June 2 (two birds) and June 1 (one bird) respectively. In 1955 Sim and Marsden saw several individuals near the head of the fiord as early as May 31. They first appeared at Eureka that year on June 4 (two birds). On June 5 and 6 as many as 33 individuals at one time were at Eureka. Flocks continued to arrive in mid-June. Migration reached a high point at 1.30 a.m., June 14, when 200 or more individuals gathered over the delta near Eureka and flew northwestward *en masse*.

A female with an ovum 12 mm in diameter was collected June 4. Although a male specimen was not collected until June 10, both sexes probably arrived at the same time. Copulation was observed June 8. The Jaegers chased each other playfully above the shore and fiord ice, but no special courtship displays were noted.

Nesting. In Ellesmere Island nesting of the Long-tailed Jaeger has been reported from the north coast (Feilden, 1877), east coast (Greely, 1886), and south coast (Bay in Sverdrup, 1904). On the Fosheim Peninsula in 1951, the behaviour of adult Jaegers "strongly suggested breeding," but diligent search by Tener failed to reveal any nests (Godfrey, 1953). In 1953 Bruggemann (1953-54) found a nest with an egg and downy chick there on July 15.

In 1955 the species nested on the barren fiord slopes as well as inland. Vegetated hummocky tundra in the vicinity of lakes and ponds was a favourite habitat. Water was not requisite, however. Of 18 nests found, the lowest was 173 feet, the highest 740 feet, above sea-level. Sim noted an individual that appeared to be nesting at 1,700 feet elevation on Northwest Ridge, June 30, 1955. In Greenland the species sometimes frequents areas of 800 metres elevation (Salomonsen, 1950-51).

All 18 nests were unlined hollows in the ground. Most were among low spreading willows. One was on the top of a hummock, another on bare ground in the hoof print of a muskox. Data concerning the 18 nests are as follows:

Nest No.	Date found	Contents when found	Clutch size	No. young hatched	Approximate hatching date
1	June 17	eggs 2	2	collected June 19	—
2	17	2	2	—	—
3	20	1	1	0 (destroyed)	—
4	22	1	1	1	July 15
5	23	2	2	—	—
6	27	2	2	2	9*
7	28	1	1	1	13
8	29	1	1	0 (destroyed)	—
9	29	2	2	2	11*
10	July 2	2	2	—	—
11	3	1	1	—	—
12	3	2	2	—	—
13	4	2	2	—	—
14	10	1 young	—	1	10
15	11	1 egg	1	1	12
16	12	1 egg	1	—	—
17	12	1 young	—	1	12
18	16	1 young	—	1	16

*First egg

In Greenland the Long-tailed Jaeger regularly lays two eggs (Salomonsen, 1950-51). On the Fosheim Peninsula one-egg clutches probably were as common as two-egg clutches in 1955.

The egg found June 22 (Nest 4) probably was fresh, for the parent birds on territory were watched regularly since June 20. The incubation period of this egg was probably 23 days since the chick hatched July 15. Manniche ascertained that the incubation period in Greenland is 23 days (Salomonsen, 1950-51).

A chick that hatched July 9 (Nest 6) was two days ahead of its sibling, which had barely pipped its shell at that time. According to Jourdain, incubation probably starts with the first egg; according to Manniche, the second egg is laid 36 to 50 hours after the first (Witherby, *et al.*, 1948).

A chick left Nest 18 within 18.5 hours of hatching. According to Pedersen, young leave the nest when "2 days old" (Witherby, *et al.*, 1948).

Both sexes incubate. At Nest 4 the male spent more time than the female on the nest. The female (sex determined by position in copulation) had been banded previously by the authors at Eureka.

In Greenland the young are fledged by early August, sometimes by late July (Salomonsen, 1950-51). On the Fosheim Peninsula, in 1953, Bruggemann (1953-54) saw one young, presumably flying, with two adults on August 19 and 28 and a single young flying on August 29. In 1955 Sim and Marsden saw three young flying 12 miles southeast of the head of

Slidre Fiord on August 9. Near Eureka on August 17, the authors shot two flying young birds—a male by itself, and a female attended by both parents, one of which was banded.

According to Pedersen the fledging period of the species is "about 3 weeks," and the young are fed by both parents "till 10 days after they can fly" (Witherby, *et al.*, 1948). A marked chick that hatched at Nest 18 on July 16, appeared at Eureka on August 19, almost exactly 34 days after hatching. It flew strongly and held its own among adult Jaegers and gulls, which it sometimes chased. But as late as August 27, within a few days of the last Jaeger departures, an adult still attended and *fed* this chick. Allowing "three weeks" for fledging period, the chick must have fledged about August 6. Thus it was fed 21 days after its supposed fledging, 42 days after its known hatching.

Departure. The Long-tailed Jaeger leaves high-arctic Greenland in August as a rule, but one bird was observed as late as October 2 in Scoresby Sound (Salomonsen, 1950-51). On the north coast of Ellesmere Island in 1951, the species was last noted on August 5 (MacDonald, 1953). On the east coast in 1882, the species was seen as late as August 30 (Greely, 1886).

Bruggemann (1953-54) noted flocks (up to 25 birds) daily at Eureka until mid-July in 1953, but the birds declined steadily in number thereafter (latest record: one bird, August 30); in 1954 he noted flocks (up to 30 birds) daily at Eureka from the second week in June to the end of July (latest record: one bird, August 13). Bruggemann observed that the Jaegers left Slidre Fiord two weeks earlier than in 1953, in spite of the fact that August temperatures were considerably higher in 1954.

In 1955 the migratory pattern of this species was anything but regular. Non-nesting birds probably started to leave the peninsula early in July when surprisingly few were seen at the fiord—a fact appreciated by even the Eureka personnel. No more than 11 were noted at any one time. During a sudden cold snap on July 7, the Jaeger count at Eureka jumped to 38, and from this time until August the species was again common. On July 29 a flock of 79 Jaegers, almost certainly transients, appeared. Thereafter the number of Jaegers declined rapidly, the largest counts for July 30 and 31 being 13 and 9 respectively. In August the Jaegers were never so abundant as during June and July, the largest single counts often being less than ten birds. On August 14 the authors banded 11 birds from a newly-arrived group. Another migratory flock of 24 paused briefly on August 16.

By mid-August many inland areas which had been inhabited by many Jaegers had few or none. On August 27 Jaegers appeared to be scarce everywhere, and for the first time since arrival of the species at Eureka the authors failed to note at least a few. Several birds visited Eureka briefly on August 31. A single bird, the last recorded on the peninsula in 1955, visited Eureka briefly on September 1.

Banding. The authors banded 127 Long-tailed Jaegers at Eureka. Had more bands been available, they could have banded three times that number. The birds were easily trapped in padded fox traps set on the ground near food scraps. From June 6 through 10, 50 birds were banded; from June 15 through 18, 53 more. No more were trapped until August. From August 7 through 14, 24 birds were banded.

In 1955 there were 19 repeats of different individuals at Eureka, not including those made on the day of banding. The more significant ones were 494-14102, banded June 6, repeated June 8, July 21, and August 10; 494-59429, banded June 9, repeated August 7; 523-50246, banded June 16, repeated August 7 and 8; 523-50264, banded June 16, repeated August 14. Only two of the birds banded at Eureka were later seen at nests, both nests being within 2 miles of Eureka. On June 6, 1959, 494-14125, banded June 8, 1955, by the authors was found dead in the vicinity of Eureka weather station. S. J. Brambley reported its recovery.

Through banding, two facts were brought to light: (1) new birds visited Eureka throughout the summer; (2) about one Jaeger in thirty *observed away from Eureka* had a band. One banded Jaeger was noted near Eastwind Lake, about ten flight miles northeast of Eureka.

Roosting. A favourite roosting spot of the Jaegers in summer was a gravel slope near the beach of Slidre Fiord east of Eureka. Here the Jaegers, probably non-breeding individuals, roosted or slept at all hours. The largest number seen there at any one time was 69 (12.45 a.m., June 12). A few of them roosted on the sea-ice, on the gravel bars of a river delta, and even on the roofs of the station buildings. The only roosting flocks seen were at the fiord. Inland single birds were often seen roosting on a rock or knoll. Here there seemed to be definite roosting hours—when the sun was low.

Food. In northeast Greenland, nesting of the Long-tailed Jaeger is subject to fluctuations which "appear" to be correlated with the size of the lemming population (Salomonsen, 1950-51). The dependence of this Jaeger on lemmings may explain its rarity in west Greenland where the lemming is absent, but it does not explain the abundance of this Jaeger in western Ellesmere Island. At Fosheim Peninsula, Bruggemann (1953-54) found little lemming sign anywhere in 1953; in 1954 he did not see a single lemming there. In 1955 lemmings were rare wherever the authors travelled. The Long-tailed Jaeger was, however, abundant from 1953 to 1955, inclusive. Although many Jaegers nested on the peninsula in 1955, scarcity of lemmings may well have been one reason for the appreciable non-breeding population and high per cent of small clutch size.

The Eureka station furnished the Jaegers with an artificial food supply, but this food could hardly have had much effect on the peninsular breeding population as a whole. Many Jaegers that fed at Eureka were probably non-breeding birds. A marked Jaeger that nested about 1.8 miles northeast of Eureka was seen only three times at Eureka throughout the summer, clearly indicating that this bird fed elsewhere.

When the shore leads formed on the fiord, some Jaegers fed on marine animals. Inland, the Jaegers fed principally on insects and their larvae—a fact noted elsewhere in Canada (Manning, *et al.*, 1956). A female specimen, collected near Slidre Fiord on June 7, 1951, by Tener (Godfrey, 1953), had eaten a small bird; a female specimen collected by him June 13 had eaten three caterpillars. Of the adult specimens taken near Slidre Fiord in 1955, a male had eaten three caterpillars (June 10); a female, 28 caterpillars and one spider (July 6); a male, 11 grubs (August 16). A

few fish bones were found in the stomach of a female (August 17). Following its capture on August 29, one individual regurgitated six polar tomcods (*Boreogadus saida*).

A chick, less than three days old, regurgitated the remains of crane-flies and a Snow Bunting fledgling on July 15. In Greenland, young Long-tailed Jaegers are "fed with insects for the first 10 to 12 days" and then with lemmings (Salomonsen, 1950-51).

An insect of widespread distribution on the Fosheim Peninsula in 1955 was the moth *Byrdia*. In late May and early June the spiny caterpillars of this moth were abundant in the lowlands, but apparently no birds took advantage of such a plentiful early food supply. Once the pupae had formed, however, the Jaegers ripped open the cocoons and ate the contents.

The cries of young Knots and Turnstones invariably called in the hunting Jaegers. An unfledged Knot (weight 50.2 gm) that the authors released after banding was carried off by a Jaeger. No Jaegers were seen attacking adult or fledged Knots and Turnstones. One Jaeger failed repeatedly to catch a recently fledged Arctic Tern. Jaegers on the hunt were attracted to other Jaegers defending eggs or young. The defenders attacked the intruders as they would have any others.

Predation. The attitude of the Long-tailed Jaeger toward the arctic fox clearly showed that mammal to be a principal predator of the species. The Jaegers harassed foxes relentlessly. A fox with a Jaeger's egg in its mouth was seen near Eastwind Lake. Recently fledged Jaegers were preyed upon by Gyrfalcons. The fresh remains of a young Jaeger were at the foot of a Gyrfalcon cliff south of Slidre Fiord. Near by, on a pinnacle, two young Gyrfalcons fed on the remains of another.

Sub-adults. Only two Long-tailed Jaegers in sub-adult plumage were seen by the authors in 1955 (Slidre Fiord, June 20 and July 22). This is surprising in view of the fact that a "good number" of immature birds follow the adults to the breeding places in high-arctic Greenland (Salomonsen, 1950-51). If Bent (1921) is correct in stating that the long central rectrices are not assumed until the second postnuptial moult, the birds seen at Slidre Fiord were probably in first summer plumage, as illustrated in Witherby, *et al.* (1948, 5: plate 139).

Specimens. Five adult males [weight 237.7 to 325.3 gm (av. 285.2), wing chord 295.0 to 308.0 mm (300.2), bill (anterior edge of nasal fossa to tip) 11.5 to 12.5 (11.9), tarsus 39.0 to 43.0 (41.1)] and eight adult females [weight 237.7 to 385.0 (312.6), wing chord 290.0 to 315.0 (299.1), bill 11.0 to 12.5 (11.8), tarsus 40.0 to 44.5 (42.1)] were collected at Fosheim Peninsula from June 4 to August 29, 1955.

The white on the underbody parts of the Fosheim Peninsula males is more extensive, on the average, than that of the females, i.e., the males appear to be paler ventrally. The lower belly feathers of some of the females are solid grey, and the greyness extends far anteriorly. In other females the grey is less extensive and more or less diffused with white, a condition also found in some of the males. Generally, the palest birds are males; the darkest birds are females; and intermediate stages exist in which there is some overlapping between males and females. Age as a factor in this phenomenon has not been demonstrated, so far as known.

This sort of sexual dimorphism in Canadian Long-tailed Jaegers, other than Fosheim Peninsula birds, was noted by Manning, *et al.* (1956) who questioned the validity of *S. l. pallescens*, a pale (ventral parts) New World race, apparently based on specimens undifferentiated as to sex. Under these conditions, the authors also consider *pallescens* unacceptable.

The summer plumage of the Long-tailed Jaeger is acquired by a complete moult, apparently in early spring (Witherby, *et al.*, 1948). All Jaegers handled by the authors in June were in summer plumage, but a male (June 10) had some of its rectrices still partially sheathed.

The species has an autumn moult (October and probably later) involving all body plumage, but it is not known when the wing and tail feathers are shed (Witherby, *et al.*, 1948). One female (July 6) had numerous pin-feathers on body, neck, and leg regions, but this was not true of other specimens, including those collected in late August. No regular moulting of the remiges was noted. Some Jaegers observed in July and August had rectrices missing, but none of the specimens show this condition.

A male juvenile (weight 284.5, wing chord 267.0, tail 130.0) and a female juvenile (weight 410.9, wing chord 272.0, tail 136.0) collected at Fosheim Peninsula on August 17, 1955, are strikingly paler, particularly on the head and underbody regions, than two juveniles¹ collected at Cape Dorchester, Baffin Island, in 1953. According to Witherby, *et al.* (1948) the juvenal (and first-winter) plumage of this species is variable.

The set of two eggs (each 51.0 by 39.0 mm) collected near Slidre Fiord on June 19, 1955, is of the pale variety, being light greenish brown and marked sparingly with lavender and brown.

Annual breeding cycle. Arrival of the Long-tailed Jaeger at the Fosheim Peninsula takes place in late May and early and mid-June. Pairing starts in early June, and pairs are soon common inland as well as at the fiord beaches where non-breeding birds congregate in summer. First-year birds are rare at Slidre Fiord. The nesting habitat is varied. Egg-laying commences in mid-June and continues into late June. The clutch size is one or two. Incubation starts with the first egg. Both sexes incubate. The period of incubation is approximately 23 days. Eggs hatch in early and mid-July. Both sexes attend young during and after fledging. Fledged young occur as early as August 9, probably earlier. Some fledged young are attended by adults until departure in late August. The postnuptial moult does not occur on the nesting grounds. Migration of non-breeding birds probably commences in early July. The last Jaegers leave the peninsula in late August. None have been seen at Slidre Fiord after September 1.

***Larus hyperboreus* Gunnerus Glaucous Gull**

The Glaucous Gull has been recorded regularly at the Fosheim Peninsula where it breeds in widely scattered pairs. In 1955 it was conspicuous but not common at the coasts. Probably no more than five or six pairs bred in the vicinity of Slidre Fiord. Inland, the species was decidedly scarce. Ellesmere Island birds belong to the nominate race *Larus hyperboreus hyperboreus*.

¹Specimens in Sutton Collection.

Arrival. The Glaucous Gull arrives at its breeding places in northern Greenland before the ice breaks—in early June in Peary Land (Salomonsen, 1950-51). It also arrives early in Ellesmere Island, before the thaw, and as early as May 23 on the north coast (MacDonald, 1953). On the south coast it arrives in the "latter half" of May (Bay, in Sverdrup, 1904). At Fosheim Peninsula its arrival has been noted several times. Tener (Godfrey, 1953) first noted it at Slidre Fiord in 1951 on June 3 (two birds). Bruggemann (1953-54) first noted it at Slidre Fiord in 1953 on May 28 (one bird) and in 1954 on May 25 (two birds).

In 1955 the authors first noted the Glaucous Gull on May 26—four birds on frozen Slidre Fiord, eleven days before the streams commenced flowing. On May 27 eight Glaucous Gulls in a loose flock were on the sea-ice offshore from Eureka. Some of them went about in pairs. One pair copulated. Thereafter the species could be found at Slidre Fiord throughout the summer. A few fed regularly on the artificial food supply at Eureka. One or two of these birds were about at almost any hour.

Nesting. Bay (in Sverdrup, 1904) stated that the Glaucous Gull was the "commonest" breeding gull of King Oscar Land in southern Ellesmere Island. Most of the many gull nests found by the Second *Fram* Expedition were probably of this species. A single egg from Ellesmere Island (June 25, 1901) was preserved by that expedition (Schaanning, 1933). Feilden (1877) stated that the Glaucous Gull nested at Cape Sabine. In the vicinity of Fort Conger it was common in 1881-83, but no breeding places were found according to Greeley (1886). Apparently, all observers on the north coast failed to find nests.

Several nests have been found at Fosheim Peninsula. Hatfield (in Handley, unpub. MS.) mentions a nest that was found on a steep bank near Eureka in 1948, but he gives no details. In 1953 Bruggemann (1953-54) found two nests. The first, at 1,750 feet elevation, was on a high rock "turret" several miles inland along the west slope of Black Top Ridge. The second, at 800 feet elevation, was in a narrow gorge near the head of Slidre Fiord. Both nests were inaccessible, but he could see into them from ledges close by. At one of the nests he saw a young bird on July 31, at the other nest a young bird on September 5. He did not visit the sites in 1954.

No gulls nested far inland along the west slope of Black Top Ridge in 1955, but one pair nested at the gorge, no doubt the same one found previously by Bruggemann near the head of Slidre Fiord. The 1955 nest ledge, halfway up the north wall of the gorge, was conspicuous. An unusual growth of flowers indicated that the spot had been used by birds for a long time. Both parent gulls were at the nest ledge on July 18 and 19, and one incubated (or brooded) while the other, the larger and probably the male, stood guard. On August 9 the nest ledge was deserted. No gulls of any age were seen there again that year.

Young Glaucous Gulls were seen flying at Slidre Fiord in late August and early September of 1949 (Hatfield, in Handley, unpub. MS.). Bruggemann (1953-54) saw two young with an adult on an ice-floe in Eureka Sound on September 8, 1954. The young, barely able to fly, almost hit the water when flushed.

The nest of a pair of gulls (male banded at Eureka) that bred in 1955 on the high rocks of Hare Cape at the mouth of Slidre Fiord was not found, but the parent birds and two young from that nest appeared at Eureka on September 1. Both young were flying strongly. All four birds flew off together. Young that were seen in mid-September were single, unattended individuals.

Departure. Adult Glaucous Gulls leave their high-arctic breeding places in Greenland early in September, the young birds lingering until freeze-up (Salomonsen, 1950-51). On the north coast of Ellesmere Island the species has been recorded as late as September 1 (Feilden, 1877). In southern Ellesmere Island the species remains as long as there is open water (Bay, in Sverdrup, 1904).

On the Fosheim Peninsula, Bruggemann (1953-54) saw an adult Glaucous Gull as late as September 28, after the freeze-up in 1954. The authors last saw an adult at Slidre Fiord in 1955 on September 12 and a young bird on September 17. The fiord froze shut during that period.

Banding. By setting padded fox traps near food scraps at Slidre Fiord, the authors caught six Glaucous Gulls. Five were banded and marked with various bright colours on their right or left wing primaries. By noting both marked and unmarked birds, it was ascertained that at least 10 adult Glaucous Gulls visited Slidre Fiord at one time or another in 1955.

The first bird, a small female, was banded May 28. It was seen near Eureka with its larger mate on May 29 and 30. It was last seen there (by itself) on June 14. The second bird, a large male, banded May 31, was seen regularly throughout the summer. It was the gull that nested somewhere on Hare Cape. Another male that was banded June 15 was not seen again after June 16. A female banded June 16 and a male banded June 25 were not seen again.

By noting the painted primaries of one bird throughout the summer, it was concluded that its primaries were shed gradually. On September 12 this bird still retained two coloured primaries (right wing). As early as June 25, a primary dropped from the wing of an unbanded individual circling above the authors.

Food. The Glaucous Gull is a predator of renown, but the only bird that the authors saw it viciously attack was a nearly fledged Greater Snow Goose (Slidre Fiord, August 26, 1955). Nesting Arctic Terns repeatedly drove them off effectively. At Eureka the Glaucous Gulls were mostly interested in the artificial food supply. Always shy, they almost never alighted on the station grounds, preferring to watch from ice-floes or gravel bars near by. A Jaeger or Thayer's Gull, flying with a food scrap, was immediately set upon by the Glaucous Gull and forced to surrender the food. Occasionally the Glaucous Gulls picked at wolf and seal carcasses near Eureka, but they usually eyed them with suspicion. The stomach of a male collected June 24 contained seal hair. When the ice broke on the fiord, the Glaucous Gulls fished for sculpins.

Specimens. One adult male (flattened wing 450.0 mm, exposed culmen 64.0, tarsus 70.5) was collected at Fosheim Peninsula June 24, 1955. It had a brood patch.

Annual breeding cycle. The Glaucous Gull, conspicuous but uncommon, arrives at Fosheim Peninsula in late May or early June, before the spring thaw and the formation of shore leads. Either it is mated on arrival or pairs soon form after arrival. It breeds in widely scattered pairs, placing its nest on precipitous cliffs or steep banks. Egg-laying probably takes place throughout June, hatching throughout July. Young have been seen at the nest as late as September 5, but most young probably fledge in August. Both sexes attend young until after fledging. Most adults leave the region by mid-September, exceptionally as late as September 28. Young break from parental ties and remain in the region somewhat later than most adults.

***Larus thayeri* Brooks Thayer's Gull**

Thayer's Gull has been uncommon on the Fosheim Peninsula, not all observers since 1947 having seen it. In 1955 it was uncommon there, but less so than the more conspicuous Glaucous Gull. No breeding areas are known for the peninsula.

In June, 1901, several gulls, supposedly "*Larus kumlieni*," were collected by J. S. Warmbath at Buchanan Bay on the east coast of Ellesmere Island (Bent, 1921). These were described by W. S. Brooks (1915) in 1915 as a new species, *Larus thayeri*. Opinion has differed radically as to what "*Larus thayeri*" is. Many ornithologists and The American Ornithologists' Union (1957) consider it the northernmost New World race of the Herring Gull (*Larus argentatus*). Others, notably Hørring and Salomonsen (1941) and Salomonsen (1950-51), consider it conspecific with the Iceland Gull (*Larus glaucoides*). The works of Manning, *et al.* (1956) and Macpherson (unpub. thesis) strongly support the hypothesis that *thayeri* is closer to *glaucoides* than *argentatus*, a view also held by the authors. However, there seems to be little evidence to date to indicate whether or not *thayeri* and *glaucoides* are reproductively isolated. Until better understood, the authors refer *thayeri* to species status.

Members of the 1953 Axel Heiberg Expedition to Mokka Fiord (about 40 miles southwest of Eureka) saw as many as 15 Thayer's Gulls nesting on cliffs near Buchanan Lake (verbal comm.). They saw the nests but did not climb to them. The authors visited this area briefly on July 26, 1955. Two Thayer's Gulls were seen flying toward the cliffs.

Arrival. Little is known about the migration of Thayer's Gull. It winters along the Pacific Coast from British Columbia to Baja California. In Alaska it is seen in the autumn, when it migrates along the coast, but not in spring when it probably keeps well out to sea (Bailey, 1948). It probably arrives in southern Ellesmere Island by late May, for Bay (in Sverdrup, 1904) stated that the "herring gull" arrived there then, about the same time as the Glaucous Gull. Arrival dates for northwest Greenland apparently are not known (Salomonsen, 1950-51).

At Slidre Fiord, Tener (Godfrey, 1953) saw two gulls, "probably *thayeri*," on June 12, 1951. In 1953 Bruggemann (1953-54) recorded "*Larus argentatus*" there on June 9 (two birds), but in 1954 he did not record it until July 12 (one bird). In 1955 the authors first noted Thayer's Gull on June 10. From a loose flock of six birds that appeared at Eureka

that day, three males (largest testis 23.0 by 21.0 mm) and two females (largest ovum 10.0 by 8.5) were collected. These birds appeared to be paired. Their cries were at once distinguishable from those of the Glaucous Gull which had arrived 16 days earlier.

Nesting. Apparently Thayer's Gull is absent on the north coast of Ellesmere Island, for neither Feilden (1877) nor MacDonald (1953) saw it. Thayer's Gull breeds, however, at least as far north as Buchanan Bay on the east coast. Several sets of eggs were collected there by Warmbath (Brooks, 1915). Bay (in Sverdrup, 1904) stated that "*L. argentatus*" often bred at the same place with the Glaucous Gull in southern Ellesmere Island.

In 1955 Thayer's Gull was noted regularly at Slidre Fiord (but not elsewhere on the peninsula) from the time of its arrival until August. It is not certain, however, that it bred there. A pair was seen copulating near the fiord shore on June 18, and birds which flew low overhead in July appeared to have brood patches. These birds conceivably could have nested in Axel Heiberg Island. Young have not been reported from Slidre Fiord.

At least 16 Thayer's Gulls visited Slidre Fiord in 1955. The largest number seen there at any one time was eight, on June 20. By this time eight specimens had been collected. Thayer's and Glaucous Gulls visited Eureka daily for food scraps, but the two species never fraternized.

Departure. Bay (in Sverdrup, 1904) stated that both "herring" and Glaucous Gulls remained in southern Ellesmere Island as long as there was open water. At Slidre Fiord, Bruggemann (1953-54) last noted the species in 1953 on July 25 (two birds) and in 1954 on August 25 (one bird). In 1955 the authors saw four birds at Eureka on August 1, and a single bird there on August 2, 3, 4, and 9. So few of these birds have been seen at Slidre Fiord during August, that it seems unlikely that they nest there. Departure dates are not given for Greenland (Salomonsen, 1950-51).

Specimens. Four adult males [weight 1028.0 to 1151.5 gm (av. of three 1093.0), wing chord 406.0 to 411.0 mm (409.2), flattened wing 416.0 to 423.0 (419.5), tail 163.0 to 173.0 (170.0), exposed culmen 49.5 to 52.0 (45.7), tarsus 63.0 to 64.5 (63.6)] and four adult females [weight 846.0 to 980.0 (av. of four 898.9), wing chord 381.0 to 408.0 (395.8), flattened wing 387.0 to 418.0 (405.0), tail 154.0 to 169.0 (162.8), exposed culmen 44.0 to 48.0 (45.7), tarsus 53.5 to 60.5 (57.7)] were collected at Fosheim Peninsula June 10 to 20, 1955.

The tips of the primaries (excluding white mirrors) grade from dark grey to grey to very light grey in the four males; from very dark grey (nearly black) to grey in four females. The fifth female has the entire wing tips white or nearly white and is the only one of the series (both sexes) that differs greatly in wing tip pattern from the type specimen (see Dwight, 1917:413-4). According to A. H. Macpherson (verbal comm.). Thayer's Gulls with grey to light grey wing tips appear to be numerous in the breeding range only at high latitudes. The Eureka specimens bear this out.

Water-colour sketches were made (by S. D. MacDonald) of eyes of the freshly killed specimens. These and other eye sketches have been examined by Macpherson and will be reported on later by him.

Annual breeding cycle. Both sexes of Thayer's Gull arrive at Slidre Fiord about June 10, considerably later than the Glaucous Gull. Nothing is known of its nesting on the Fosheim Peninsula. Few adults and no young of any age have been seen in August, none after August 25.

***Sterna paradisaea* Pontoppidan Arctic Tern**

Since 1947 the Arctic Tern has been conspicuous but not abundant in summer on the Fosheim Peninsula. At Slidre Fiord it nests in isolated pairs or in small colonies on gravelly deltas. It probably nests near Iceberg Point and elsewhere along the shores of Greely Fiord where it has been seen. It also probably nests north through Nansen Sound where a single bird was noted by Roots at 80°46'N., 88°23'40"W. on July 24, 1955. No large colonies are known for west-central Ellesmere Island.

Arrival. Records (Feilden, 1877; Greely, 1886; MacDonald, 1953) indicate that the Arctic Tern arrives in northeastern parts of Ellesmere Island in mid- and late June, which is somewhat later than arrival dates (first half of June) stated by Salomonsen (1950-51) for high-arctic Greenland. On the Fosheim Peninsula the arrival has been recorded (Tener, in Godfrey, 1953; Bruggemann, 1953-54) at Slidre Fiord several times—in 1951 on June 16 (two birds), in 1953 on June 23 (two birds), in 1954 on June 19 (one bird).

In 1955 the authors first noted the species on June 10—a single bird flying above the flooded sea-ice near Eureka. One bird was seen there on June 11, 12, and 15. Two, possibly a pair, were there on the 16th. Eleven were seen at once on June 18, and thereafter the species could be seen anytime in summer along the fiord shore.

Nesting. Nestings of the Arctic Tern have been reported from the north and east coasts of Ellesmere Island (Feilden, 1877; Greely, 1886; MacMillan, 1918; MacDonald, 1953), and apparently the species has nested abundantly along the south coast (Bay, in Sverdrup, 1904). On the Fosheim Peninsula, Duvall and Handley (1948) visited three small colonies at Slidre Fiord in 1947, finding unfledged young on August 9 and 10. One young was entirely downy, another was "feathering." In 1951 Tener (Godfrey, 1953) found a nest with one egg at Slidre Fiord on July 14, and two nests each with "newly-hatched" young there on July 23. Bruggemann (1953-54) estimated that four or five pairs bred about the fiord in 1953. Apparently few Terns bred there in 1954.

A minimum of 14 pairs were at Slidre Fiord in 1955. Non-breeding Terns were rare or absent. The largest colony was at a delta almost directly across the fiord from Eureka, and there, on August 20, the authors counted 12 flying adults.

Although the Terns were not paired on arrival, some were going about in pairs and viciously defending certain areas in late June. Eggs, however, probably were not laid until early July. Of three nests found, one had a single egg and the others had two eggs each (July 5, 19, and 21, respectively). Only one egg of each two-egg clutch hatched. Several spoiled eggs of another year were found in the nesting areas. All of these eggs were simply laid on gravel or sand. Both sexes incubated and cared for the young.

Two pairs of Terns that nested on the same delta near Eureka were observed regularly. The single egg (found July 5) of one pair was probably laid on July 4. It hatched between 3.00 and 3.15 p.m. on July 25—at least 476 hours, or approximately 20 days, after its discovery. According to Direksen (in Witherby, *et al.*, 1948) the period of incubation is 21 to 22 days.

On July 27 the chick (banded) was 5 feet from the nest, on August 5 about 150 yards. It never ventured much farther as a chick. It was still downy and of "grey phase" (see Bent, 1921). When examined August 14, its flight feathers were well developed, but it was not ready to fly. When released, it ran swiftly to the water and swam 30 or more yards out into the heavy swells. One parent (banded) kept diving at the chick. The following day, ice drifted against the shore. The chick swam out and hid in a crevice.

This chick was able to fly a little on August 17 (23 days after hatching). At 11.00 a.m. it made several feeble flights of about six feet each and was easily caught. Five hours later it made several long flights (100 feet or more) from the beach out over the fiord. On one such flight the parent struck it a glancing blow, forcing it to the water. Thereafter the chick could not be caught. In a few hours it had advanced from a weak flyer to a fairly strong one; but it did not acquire the characteristic flight of the adult for another two days. By August 19, 25 days after hatching, it flew strongly and skilfully and was fully fledged. The minimum time needed for fledging in this case was 23 days. In one Greenland nesting the period for fledging was 21 to 23 days (Nicholson, 1930).

The second nest under observation was about 120 yards from the first. When found July 21, incubation was advanced. One of the two eggs hatched between 4.00 and 4.20 p.m. on August 4. This chick was of "brown phase." On August 27, 23 days after hatching, it was flying fairly strongly and could not be caught. The other chick, flying near by, was considerably older and noticeably stronger of wing.

At the colony across the fiord from Eureka, two fully fledged young birds were seen on August 20.

Departure. On the north coast of Ellesmere Island, MacDonald (1953) noted 11 Arctic Terns as late as September 3 in 1951. On the Fosheim Peninsula the species has been reported (Duvall and Handley, 1948; Bruggemann, 1953-54) from Slidre Fiord in late August—in 1948 on August 28 (two birds), in 1953 on August 29 (one bird). Bruggemann (1953-54) states that in 1954 Arctic Terns, as well as several other species, left Slidre Fiord two weeks earlier than in 1953, in spite of the fact that August temperatures were highest in 1954. The species leaves high-arctic Greenland from mid-August to early September (Salomonsen, 1950-51).

In 1955 the first sign of migration was noted on August 29, when a flock of 31 Terns flew east past Eureka at 9.30 p.m. On September 1, four parent birds and two young were at Eureka delta, as usual. The authors searched for Terns up and down the fiord on September 2, but not one was seen. The young Tern that fledged at Eureka delta presumably started its southward migration less than a week after it started flying.

Food. The stomach of an adult Tern collected by Tener at Slidre Fiord on June 17, 1951, contained amphipods (Godfrey, 1953). An adult collected by the authors on August 20, 1955, had eaten a small squid, and another collected on August 23 had eaten three amphipods. Unfledged chicks handled by Duvall and Handley (1948) on August 9 to 10, 1947, and by the authors on August 14, 1955, regurgitated fish remains only.

The Terns were often seen feeding in the shore leads among ice-floes, or in the open sea, but the authors were surprised on July 30 to see them inland, catching insects. Near Slidre Fiord several hovered over the tundra, darting this way and that, occasionally alighting. Several more were far inland catching craneflies on the tundra near Eastwind Lake. The eating of craneflies by Arctic Terns has been observed elsewhere (Wright, 1909).

Predation. The Arctic Tern is well known for its ability to defend its eggs and chicks against enemies. The Slidre Fiord colonies were small, but the attacks of a few birds were effective against predatory birds.

Not once was a predator seen attacking an adult Tern. Wilkie's and Breckenridge's (1955) observations of "hapless" Arctic Terns pursued by Long-tailed Jaegers are of interest in this connection. The authors did see a Jaeger chasing a recently fledged juvenile on August 20. The young Tern escaped the Jaeger's repeated attacks by diving downward and turning quickly to one side. The parent flew at the Jaeger and finally drove it off.

Several times the Eureka station dogs escaped and ran out on the delta. The Terns attacked them but not effectively. Wolves and foxes were abundant. Their tracks indicated that they frequently patrolled the beaches.

Specimens. Two adult males [weight 97.5 to 105.2 gm, flattened wing 269.0 mm each, entire culmen 30.0 to 31.0, tarsus 13.5 to 16.0] and three adult females [weight 100.0 to 101.4, flattened wing 266.0 to 279.0 (av. 274.6), entire culmen 28.0 to 31.5 (30.0), tarsus 14.5 to 17.0 (16.0)] were collected at Slidre Fiord from August 4 to August 23, 1955. All of these birds were breeding; none was moulting heavily.

Manning, *et al.* (1956) found that culmen and tarsal lengths (for both sexes, considered separately) of a series of Arctic Terns from western North America are significantly shorter than those of a series from eastern North America; that some Ellesmere Island birds fit better with the western series; and that the difference between the two series is greater if the Ellesmere Island birds are omitted. They suggest that Terns from both Pacific and Atlantic coasts occur in Ellesmere Island, either breeding in different localities, or one or the other occurring there as non-breeding wanderers.

In the above 1955 series it can be readily seen that there is a spread in individual culmen and tarsal lengths. The average measurements do, however, compare favourably with the averages (culmen 30.86, tarsus 15.45) stated by Manning, *et al.* (1956) for seven Ellesmere Island birds (six males, one female). This suggests that Slidre Fiord birds are from the west. But it must be pointed out that migration of Arctic Terns from Slidre Fiord appeared to be *east* rather than south or west in 1955. A larger series of specimens and banding returns would shed light on this interesting problem.

Annual breeding cycle. The Arctic Tern arrives at Slidre Fiord chiefly in mid- and late June. Pairs form in late June. These nest in isolated pairs or in small colonies at the river and creek deltas. Eggs are laid in early and mid-July. The clutch size is one or two. Both sexes incubate. The period of incubation is at least 20 days, probably 21 to 22 days. Chicks hatch in late July and early August. The chicks fledge when about 23 days old in mid- and late August. Young are attended by both parents until they migrate. They may migrate within a week of fledging. The postnuptial moult is not completed on the nesting grounds. Parent and young birds leave the fiord in late August and early September.

***Nyctea scandiaca* (Linnaeus) Snowy Owl**

The Snowy Owl is rare on the Fosheim Peninsula, and there is no evidence that it breeds there. Both Feilden (1877) and MacMillan (1918) found it nesting in the vicinity of Cape Sheridan on the north coast of Ellesmere Island in 1876 and 1909 respectively, but MacDonald (1953) found no evidence of its nesting there in 1951. On the east coast, both Feilden (1877) and Greely (1886) found it breeding abundantly in the vicinity of Discovery Harbour in 1876 and 1881-83 respectively. On the south coast, Bay (in Sverdrup, 1904) found it decidedly uncommon in 1900-02.

Duvall and Handley (1948) state that a Snowy Owl was observed at the Fosheim Peninsula on August 9 or 10, 1947. In 1951 Tener (Godfrey, 1953) observed the species there four times (one bird on each occasion). Bruggemann (1953-54) did not observe it at all in 1953-54. In 1955 it was seen only occasionally. In widely scattered places it was noted June 2, 11, July 6, 18, 19, August 3, 6, September 14 and 21—a single bird on each date. No bird that was seen hooted or made the slightest move in defence of nest territory. Several roosting rocks were found but nothing that suggested old nest sites. Lemmings were extremely scarce in 1955, as they were in 1953-54. Arctic hares were abundant, but the authors found no evidence that the owls fed on them. In Greenland the Snowy Owl nests only in the high-arctic region inhabited by the lemming (Salomonsen, 1950-51).

***Corvus corax* Linnaeus Common Raven**

The Raven has been noted only infrequently on the Fosheim Peninsula, and there is no convincing evidence of its nesting anywhere in the region. In 1955 it was seen at Slidre Fiord on two occasions. Ellesmere Island birds are referred to the race *Corvus corax principalis*.

The species ranges northward to high latitudes, but apparently the northernmost records are not breeding records. Far northern Greenland records are of wandering, non-breeding birds (Salomonsen, 1950-51). In the Canadian Arctic Archipelago the species has nested as far north as 76°16'N., at Mould Bay, Prince Patrick Island (MacDonald, 1954). Although Hellmayr (1934) states that the species breeds northward to northern Ellesmere Island, the authors know of no nestings for the island. Neither Feilden (1877) in 1876 nor MacDonald (1953) in 1951 saw the species at all on the north coast. Greely (1886) noted it only occasionally on the east coast in 1881-84 (specimen taken September 28, 1882). In

1900-02 it was seen frequently on the south coast where it probably nested (Bay, in Sverdrup, 1904). It was noted at Craig Harbour on August 26, 1938, and August 22 to 24, 1939 (Shortt and Peters, 1942).

Duvall and Handley (1948) state that a Raven was seen near Eureka a few days previous to their visit there on August 28, 1948. In 1952 Troelsen (1952) saw one near Slidre Fiord in late June. Bruggemann (1953-54) did not see the species at all in 1953-54. In 1955, on June 5, the authors saw two Ravens flying up Slidre Fiord. A mile or so east of Eureka they circled high above the ice, then separated, one crossing the fiord and flying southwest toward Axel Heiberg Island, the other disappearing eastwards. Several hours later one was heard calling near Eureka. It flew northward. These two or three birds were in heavy moult. Their wings presented a ragged appearance even at a distance.

According to Salomonsen (1950-51), the species probably does not breed beyond the northern limit of seabird colonies, an important source of food for nesting Ravens in Greenland. Although there were numerous cliffs on or near the Fosheim Peninsula, there were no seabird colonies aside from the small colonies of Arctic Terns. No Ravens have been attracted to the artificial food supply at Eureka station (cf. Sutton and Parmelee, 1956a).

***Oenanthe oenanthe* (Linnaeus) Wheatear**

Heretofore the Wheatear has not been reported from the Fosheim Peninsula. In 1955 it was rare at Slidre Fiord. It nested in rocky areas of the interior, probably in widely scattered pairs. Apparently there are few records of Wheatears, not to mention nestings, in all of Ellesmere Island. Sverdrup (1904, 1:181-2) noted the species at Bay Fiord on the west coast in June, 1899. MacMillan (1918) states that it migrates in spring to the edge of the Polar Sea. The Wheatear of northeastern Canada is referred to the race *Oenanthe oenanthe leucorrhoa*.

No Wheatears were seen by the authors in early spring. The first one seen was a male near Slidre Fiord on June 22. This bird was not on territory. The species was not seen again at the fiord.

Nesting. A male Wheatear was seen on the west slope of Black Top Ridge, about seven miles north of Slidre Fiord on July 6. When the authors returned to this area on July 14, they watched a female Wheatear carry mouthful after mouthful of food to a protruding mass of rock, high on a steep west-facing slope. The nest crevice was among loose rocks, the nest being a few inches back from the opening. In the nest were five well-developed young. An unhatched egg (no developed embryo within) lay beside it. The nest was a single layered, unlined structure of dry grass. When touched, all of the brood bolted and scampered back into a narrow crack. The authors collected two of them and the female parent. The parent bird had recently eaten several crane flies and spiders and one bee.

On July 15 the male parent was about, but it was wary. The three remaining chicks had returned to the nest and were lively in spite of the inclement weather that had set in some hours before. These birds probably fledged within a day or two. In southern Baffin Island one brood was ready to leave the nest as early as June 25, another as late as July

16 (Sutton and Parmelee, 1954a). At the northernmost breeding ground of the species in Greenland, fledging takes place about mid-July (Salomonsen, 1950-51). Allowing 25 days for incubation and fledging (Witherby, *et al.*, 1948), egg-laying at the Fosheim Peninsula nest probably began in mid-June.

This Wheatear's nest was at 897 feet elevation in an area densely populated with Snow Buntings. The Buntings, whose young had fledged, chased the Wheatears repeatedly. The two species have almost the same habitat in Greenland (Salomonsen, 1950-51) and in southern Baffin Island (Sutton and Parmelee, 1954a).

The authors did not see the species again anywhere on the peninsula in 1955, but it may well have been more abundant than their records indicate. The authors did not often visit the rocky interior, a habitat well suited to the Wheatear's breeding needs.

Specimens. The adult female (weight 27.6 gm, wing chord 100.0 mm) collected north of Slidre Fiord on July 14, 1955, had not started its post-nuptial moult, although its plumage was worn. The flight quills of its two chicks (males: weight 29.1 to 29.8, wing chord 53.0 each, tail 14.0 each) were bursting from their sheaths. Natal down was still conspicuous on their heads and backs. Some down was lost in preserving the specimens.

Annual breeding cycle. Nothing is known of the Wheatear's arrival and departure on the Fosheim Peninsula. In 1955 one pair nested in high rocky country well in from the sea. The clutch size was six. Five young hatched. Egg-laying probably commenced in mid-June, hatching about July 4, and fledging about July 16.

***Acanthis hornemanni* (Holboell) Hornemann's Redpoll**

Hornemann's Redpoll is uncommon on the Fosheim Peninsula, and not all observers have recorded it there. It occurs irregularly along the fiord slopes in early spring and in late summer and autumn, being mostly confined during nesting to barren inland rocky areas. Fosheim Peninsula Redpolls belong to the nominate race *Acanthis hornemanni hornemanni*.

In Axel Heiberg Island, at 80°42'40"N., 90°59'W., 18 miles northwest of the mouth of Stang Bay, in a steep rocky ravine in high country about three miles from the coast, the authors collected one (female) of three juveniles seen with a parent on July 23, 1955. This bird had eaten adult insects and buds of *Polygonum viviparum*.

Arrival. In Greenland, Hornemann's Redpoll migrates along the coast, arriving at its breeding areas early in spring (Salomonsen, 1950-51). On the north coast of Ellesmere Island, MacDonald (1953) saw the species as early as April 29 in 1951. On the Fosheim Peninsula in 1955, the authors first noted it on April 22. That day (low temperature -9.1°F.) seven or more Redpolls fed on grass seeds along the wind-swept slopes of Slidre Fiord. Two were seen near the fiord on April 25, but the species was not seen there again until May 13 (one bird). On May 13 several Redpolls were also noted well inland at about 1,000 feet elevation on the barren west

slope of Black Top Ridge—a favourite habitat for the species in summer. The authors failed to note when pairs formed. In 1953 Bruggemann (1953–54) noted a pair, apparently mated, on May 26.

Nesting. Hornemann's Redpoll breeds principally in southern parts of the high arctic in Greenland, and it is not known to breed north of Inglefield Land on the west coast (Salomonsen, 1950–51). Its breeding range in the Canadian Arctic Archipelago is not well known. Nestings have been reported from the east coast of Baffin Island (Wynne-Edwards, 1952; Watson, 1957), and the species has been seen in summer in Prince Patrick Island (MacDonald, 1954). In Ellesmere Island the species would appear to have a spotty distribution, although it is a bird that probably has been often overlooked. Probably it breeds in the vicinity of Lake Hazen (Snyder, 1957). Vibe (in Salomonsen, 1950–51) observed it in Ellesmere Island (exact area not stated) during the breeding season. According to MacDonald (1953), it probably breeds in small numbers in the Alert area on the north coast, but no nests have been found there. Many observers, e.g., Feilden (1877), Greely (1886), and Bay (in Sverdrup, 1904), apparently did not observe the species at all during their extensive travels on Ellesmere Island.

The only known Fosheim Peninsula nest was found by Bruggemann (1953–54) at about 1,500 feet elevation in a deep gorge of Black Top Ridge, on June 26, 1953. The nest was in a niche in a vertical rock wall and was inaccessible. It was discovered by watching a parent bird carrying food. Bruggemann first noted juveniles that year on July 31 (two birds)—the earliest known date for juveniles at Fosheim Peninsula.

The authors did not often visit Black Top Ridge, but when they did, they usually noted a few Redpolls. The species probably nested there in 1955. On July 6, the authors collected one adult male (largest testis 8.0 by 7.0 mm, crop: seeds) at about 1,000 feet elevation. There the slope was decidedly rough, and the plant life was stunted and scattered. In Greenland this bird seems to require willows or other large shrubs for its nesting. According to Salomonsen (1950–51), it nests in the interior where the temperatures are comparatively high and vegetation rich and tall—a breeding requirement hardly comparable to that of the Fosheim Peninsula.

August flocking. Both young and old Hornemann's Redpolls were near Slidre Fiord on August 4, 1955. That day the authors found themselves surrounded by Redpolls on a steep ridge about half a mile inland. Twenty of them were counted at once, but there must have been many more. They moved about singly and in small groups, feeding on seeds. Most of them were young birds (three males, one female collected) in juvenal plumage. Of several adults seen, one (female with brood patch) was collected. The crops of all these specimens contained seed of the poppy (*Papaver*). Similar flocking in the first half of August has been noted by several authors in Greenland (Salomonsen, 1950–51). Apparently families wander about in groups before migrating.

Departure. Although Hornemann's Redpoll is resident even in the high arctic of Greenland, the northernmost parts of its breeding grounds are vacated in autumn, migrating flocks appearing at the coast as early as mid-August (Salomonsen, 1950–51). Migrating flocks of Redpolls fly

south over the Fosheim Peninsula in the autumn. The 20 Redpolls noted by Bruggemann (1953-54) near Slidre Fiord on September 3, 1953, may or may not have been migrating; but the flocks seen there on September 8, 1955, almost certainly were from afar. At various times that day the authors saw seven, nine, two, four, and two birds that flew in high from the north and headed south over the fiord. Just beyond the beach they circled back, as if attracted to Eureka. Some alighted among the buildings. Four immature birds (three males, sex of one uncertain) and one adult female were collected. The crops of all these birds contained seed. All were in fresh winter feather.

Hornemann's Redpolls were next seen on September 14. A flock of eight flew in high from the north and passed south after circling once over Eureka. On September 17, the latest recorded date for the species at Fosheim Peninsula, the authors shot an immature female—one of two birds that had alighted near Eureka buildings. Although seed is available at all seasons on the Fosheim Peninsula, there is no evidence that Redpolls ever winter there.

Specimens. One adult male [weight 19.1 gm, wing chord 80.5 mm, tail 69.5, bill (anterior edge of nasal fossa to tip) 7.8, tarsus 16.5] collected at Fosheim Peninsula July 6, 1955, was moulting heavily. Two adult females (weight 17.0 to 19.4, wing chord 79.0 to 83.0, tail 58.5 to 68.5, bill 7.8 to 7.5, tarsus 16.0 each) were collected at Fosheim Peninsula on August 4 and September 8, 1955, respectively. The feathers of the August 4 specimen are much worn; the bird was in postnuptial moult. The September 8 specimen has fresh winter feathers.

Three immature males [weight 18.2 to 20.2 (av. 19.3), wing chord 81.0 to 85.0 (83.0), tail 66.5 to 70.0 (68.8), bill 7.5 to 7.8 (7.7), tarsus 16.0 to 16.5 (16.3)] and one immature female (weight 18.2, wing chord 81.0, tail 66.5, bill 6.2, tarsus 16.5) collected at Fosheim Peninsula September 8 to 17, 1955, were in fresh winter plumage.

Three males [weight 17.0 to 17.8 (17.2), wing chord 80.0 to 85.0 (82.5), tail 66.0 to 73.5 (68.8), bill 7.0 to 7.1 (7.06), tarsus 16.5 each] and a female (weight 16.6, wing chord 79.5, tail 63.5, bill 6.5, tarsus 16.5) collected at Fosheim Peninsula August 4, 1955, were in juvenal plumage (no red showing on crown). One female (weight 17.3, wing chord 78.0, tail 64.5, bill 7.5, tarsus 16.5) collected in Axel Heiberg Island (80°42'40"N., 90°59'W.) on July 23, 1955, was in juvenal plumage.

Unlike other September specimens, the immature female collected September 17 had numerous pinfeathers on the body. As is clearly shown by the specimen, the rectrices are not entirely free of sheathing; some of them are not full length. In *Acanthis flammea* the rectrices are not replaced during the postjuvenal moult (Witherby, *et al.*, 1948). Although the moults of *Acanthis hornemanni* are poorly known (Graber, 1955), it would appear that in the September 17 specimen, there is a replacement of feathers lost through accident.

All of the specimens discussed above are too large for the race *Acanthis hornemanni exilipes* (see Ridgway, 1901:80-5) and belong to the nominate race. Godfrey (1953) likewise referred Ellesmere Island (Alert area) Redpolls to this race.

Annual breeding cycle. Hornemann's Redpoll has appeared at Fosheim Peninsula as early as April 22. It occurs both inland and along the fiord coasts in spring, rarely at the fiord coasts in June and July. Pairs inhabit the barren inland rocky areas during nesting. One nest was in a rock crevice at 1,500 feet elevation. Females have a brood patch. Females attend fledged young, but it is not certain if males do. Family groups (up to at least 20 birds) wander about the lowlands in early August. Postnuptial moult in some males begins in early July. Some females are moulting heavily by early August, probably earlier. The winter plumage of both young and old is acquired by early September. Southward migration begins in early September and continues into mid-September. Wintering Redpolls have not been reported from the Fosheim Peninsula. The latest date for the species there is September 17.

***Calcarius lapponicus* (Linnaeus) Lapland Longspur**

The Lapland Longspur is uncommon on the Fosheim Peninsula, all observers since 1949 having seen little of it. Its status there with respect to nesting was, at first, uncertain. In 1955 the species nested on the peninsula in limited numbers. Ellesmere Island birds are here referred to the nominate race *Calcarius lapponicus lapponicus*.

Arrival. In late spring of 1955, the authors looked carefully for Longspurs, especially among the large flocks of Snow Buntings on the slopes near Slidre Fiord, but not once did they see them. If the Longspurs lingered on the coast at all, as did the Buntings, their stay must have been short. The species does not arrive in high-arctic Greenland until June (Salomonsen, 1950-51).

Nesting. The Lapland Longspur breeds principally in the low arctic. It is common on the mainland of Eurasia, but Pleske (1928) does not list it for the high latitudes of Spitsbergen, Bear Island, or the DeLong Archipelago. It is, however, alleged to range as far north as the Franz Josef Archipelago (Witherby, *et al.*, 1948). In North America, a male bird collected at Craig Harbour on the south coast of Ellesmere Island, August 26, 1938, was at that time thought to represent a "northern record" for the species (Shortt and Peters, 1942). It is now known to be a "common breeding bird" at Mould Bay (76°16' N.), Prince Patrick Island (MacDonald, 1954). In Greenland, where it breeds northward to 77°30' on the west coast, it has in "recent years spread out to the southern part of the high-arctic region owing to the climatic amelioration" (Salomonsen, 1950-51). Tener's observation (1958, in litt.) extends its known breeding range to Lake Hazen, 81°49'N.

Early records of Fosheim Peninsula Longspurs are vague. In 1949 Hatfield (in Handley, unpub. MS.) saw a "few sparrow-like birds" which he thought were Longspurs. In 1951, on August 5, Tener (Godfrey, 1953) collected two Longspurs in "well-developed juvenal plumage" near Eastwind Lake, but it was not certain from where these birds came. More than likely they were from a population now known to breed near Eastwind Lake. Bruggemann (1953-54) noted the species near the lake on July 9 and 10, 1953 (one bird on each date), and on June 28, 1954 (five birds).

In June of 1955, the authors did not visit Eastwind Lake until the 28th. That day Sim and Marsden reported seeing a male Longspur near the north shore. The following day a number of Longspurs performed flight songs as high as 100 to 200 feet above ground near the northeast shore. There the authors watched several females and followed one to a nest—a grass-lined cup (no hair or feathers) in the side of a hummock in wet, well-vegetated tundra.

On June 29 the nest held four newly hatched young and two eggs, on July 1 five young and an egg. On July 10 it was empty, except for numerous particles of feather sheath and the unhatched egg—good evidence that several chicks had left the nest successfully. Of two grass-lined nests found in southern Baffin Island, both were unsuccessful in that no young survived in them (Sutton and Parmelee, 1955).

Allowing 12 days for incubation (Wynne-Edwards, 1952), the first egg in the Fosheim Peninsula nest must have been laid about June 12. This date is no later, indeed it is earlier, than some of those of lower latitudes in Canada. In Baffin Island, egg-laying started at Clyde Inlet on the east coast in 1950 on June 6 (Wynne-Edwards, 1952); at Frobisher Bay on the south coast in 1953 on June 10 (Sutton and Parmelee, 1955); at Bowman Bay on the west coast in 1929 on June 26 (Soper, 1946); at Nettilling Lake in 1925 on June 14 (Soper, 1928). At Southampton Island in 1930, egg-laying started June 17 (Sutton, 1932). At Prince Patrick Island in 1952, it started on June 9 to 10 (MacDonald, 1954). At Banks Island in 1952, about June 5 (Manning, *et al.*, 1956). In the Upernavik District of Greenland, eggs are laid "after mid-June" (Salomonsen, 1950-51).

The 1955 Eastwind Lake population of Longspurs (about 20 pairs) occupied about two square miles of tundra. A few birds may have occupied an additional stretch of low hummocky tundra northwest of the lake where a bird was heard singing on July 10 (last song recorded). The authors noted no Longspurs otherwise between Slidre and Greely fiords, an area of roughly 400 square miles. Much of this country appeared to be suitable Longspur tundra. The species may have bred on the vast tundra east of Slidre Fiord where Sim and Marsden noted one bird on July 12.

The authors collected three adult males on the Eastwind Lake breeding grounds, one (largest testis 12.0 by 7.5 mm) on July 1, another (testis 12.0 by 8.0) on July 3, and one (testis 5.5 by 5.5) on July 4. Two of the birds had recently eaten insects (four caterpillars each). The plumage of all three specimens was worn, but the postnuptial moult had not started.

Departure. In 1955 Marsden saw a Longspur near the head of Slidre Fiord on August 1, and Sim saw one 18 miles southeast of there on August 4. These birds may have been juveniles wandering singly over the peninsula. This seemed to be the case when, on August 22, the authors collected a juvenile that was by itself on a high plain several miles south of Slidre Fiord. The specimen was a male that had nearly completed the postjuvenile moult. It had recently eaten adult insects and plant seeds. Whether these birds were migrating remains a moot question.

Both immature and adult Longspurs were among the Bunting flocks that appeared at the coast in late summer and autumn. Inconspicuous and wary, they came to Slidre Fiord early in the morning before the Bunting flocks dispersed for the day. They were first seen there on August 23, on which day one of six birds was collected. The specimen was an immature female that had recently eaten buttercup seeds. Three birds were seen August 24. On August 27, four of 11 birds were collected. One was an adult male (largest testis 2.0 by 2.0 mm) and three were immature males. All four were in fresh winter feather, and all had been eating seeds.

Migration continued into September. On September 6, a mile south of Eastwind Lake, two south-bound Longspurs flew high overhead toward Slidre Fiord. At the fiord, two were noted September 7 and two September 8. The species was last noted at the fiord on September 9—a single bird flying with 55 Snow Buntings. But as late as September 22, a few Longspurs lingered at the Eastwind Lake breeding grounds. On September 20, a male in first winter plumage was collected in a frozen creek-bed within the nesting area. In the same area, during twilight of September 21, a few Longspurs and many Buntings flushed from their roosting places on hummocky tundra. The following day a lone individual flew erratically about the nesting grounds. This was the last Longspur seen anywhere on the peninsula that year. In Greenland the southward migration takes place from mid-August to mid-September (Salomonsen, 1950–51).

Specimens. Three adult males [weight 24.9 to 31.7 gm (av. 27.9), wing chord 93.0 to 95.0 mm (94.0), tail 61.1 to 68.0 (64.2), bill from base of skull 12.0 to 13.0 (12.6), bill from anterior edge of nasal fossa to tip 8.2 to 9.5 (8.5), tarsus 20.5 to 21.5 (21.1)] collected at Fosheim Peninsula July 1 to 3, 1955, were in worn breeding plumage. One adult male (weight 28.7, wing chord 98.0, tail 67.0, bill from skull 13.5, bill from nasal fossa 8.2, tarsus 21.5) collected at Fosheim Peninsula August 27, 1955, was in fresh autumn plumage.

Five immature males [weight 27.3 to 37.4 (30.2), wing chord 92.5 to 95.5 (93.5), tail 61.0 to 67.0 (65.4), bill from skull 11.2 to 12.5 (11.8), bill from nasal fossa 7.2 to 8.0 (7.7), tarsus 21.0 to 21.5 (21.2)] collected at Fosheim Peninsula August 22 to September 20, 1955, were in fresh autumn plumage.

One immature female (weight 24.0, wing chord 89.5, tail 61.0, bill from skull 11.7, bill from nasal fossa 7.5, tarsus 21.0) collected at Fosheim Peninsula August 23, 1955, was in fresh autumn plumage.

Bill measurements of the above Fosheim Peninsula specimens do not support the separation of Greenland-Canadian birds, i.e., *C. l. subcalcaratus* (Brehm), from the nominate race. According to Salomonsen (1950–51), *subcalcaratus* is larger billed and has paler dorsal feather edgings in the autumn plumage. Manning, *et al.* (1956) found this latter condition even more pronounced in Baffin Island males. The authors, however, were not able to separate satisfactorily the five Fosheim Peninsula immature autumn males from the three Greenland autumn males (age not known) which Manning, *et al.* (1956) used in his comparison of Greenland with Baffin Island specimens.¹ Moreover, the adult Fosheim Peninsula male in

¹The Greenland and Baffin Island specimens are in the National Museum of Canada.

autumn plumage is darker than all five Fosheim Peninsula immatures and the Greenland birds. This suggests that age may be a critical factor in colour of the autumn plumage and could constitute a bias in such a taxonomic study. On the other hand, considering the juvenal plumage, Baffin Island juveniles are paler than two collected at Fosheim Peninsula in 1951. Until this whole complex is better understood, the authors refer the Fosheim Peninsula birds to the nominate race.

Annual breeding cycle. The Lapland Longspur probably arrived at its Eastwind Lake breeding ground in late May or early June in 1955. The breeding ground was well-vegetated, wet hummocky tundra. Egg-laying commenced about June 12. The clutch size at one nest was six. Young left this nest about July 9. Juveniles wandered over the country in late summer. Both adult and immature birds largely completed moulting by late August when southward migration commenced. At this time they flocked with Snow Buntings near the fiord coast. Some immature birds remained on the nesting grounds into late September.

***Plectrophenax nivalis* (Linnaeus) Snow Bunting**

The Snow Bunting is common on the Fosheim Peninsula. In 1955 it was by far the commonest species there, nesting abundantly in rough country inland. Sim and Marsden also noted it that year during July 24 to 27 at Caledonian Bay, Canyon Fiord; and the authors noted it on July 24 at several places near the northeast coast of Nansen Sound, including the south shore of Otto Fiord where five adults and a fledgling were seen. Ellesmere Island birds are referred to the nominate race *Plectrophenax nivalis nivalis*.

In Axel Heiberg Island the authors found Snow Buntings abundant at several places in 1955. On July 23, at 80°42'40"N., 90°59'W., in high country 3 miles from the coast, adults (four males collected) and fledglings were seen. On July 25, adults and fledglings were noted 5 miles west of Flat Sound and on the Schei Peninsula.

Arrival. The arrival date of Snow Buntings on the breeding grounds will vary considerably from year to year for a given locality. Apparently this variation is due to climatic variation in the breeding area (Pleske, 1928) and in the wintering area and along the migration route (Timbergen, 1939).

Snow Buntings have been seen as early as April 27 on the north coast of Ellesmere Island (MacDonald, 1953), and as early as April 13 on the east coast (Greely, 1886). Bruggemann (1953-54) first noted them at Fosheim Peninsula on May 3 in 1953 and on April 27 in 1954. In 1955 they were already at Slidre Fiord when the authors arrived there on April 16, but according to the Eureka personnel none had been seen previous to that day.

The 1955 arrival period covered a span of at least 46 days. The first arrivals were few in number and widely scattered over the lowlands near the sea. Their numbers gradually increased until by late April they were fairly abundant along the fiord shores but not inland at higher elevations.

At Angmagssalik, Greenland, in early spring, many Bunting flocks arrived following stormy weather from the east (Tinbergen, 1939)—phenomenon also noted by the authors at Slidre Fiord.

All of these early arrivals were males. Most were still more or less veiled with brown, but some were in bold black and white feather as early as April 26. The bills of these birds were black. A few Buntings started to sing complete songs at this time.

It appeared that some males were establishing territories at Eureka station early in May, for much fighting and singing occurred there. No territories were ever established there, however, and the whole station area was practically abandoned by males even before arrival of the females.

It was not until May 8 that Buntings were observed far inland—a flock of five males flying near Eastwind Lake. Up to that time the authors had failed repeatedly to find them or their tracks far from the low coastal areas. By mid-May some males were definitely defending territories in deep gullies near the fiord. Males seen at 2,000 feet elevation on May 13 were, however, going about in flocks. There the aspect was decidedly wintry.

The first female seen was at about 2,000 feet elevation on May 21. With it was a male in black and white feather. The two birds moved together over the rocky ground. Flying to a rock wall, they popped in and out of niches as if looking for a nest site. When they left, the male rose to a height of 10 feet and fluttered to the ground in full song—the first *display song* noted in 1955. Other males were singing full songs on territory, but they appeared to be mateless. On May 24, 1951, at Slidre Fiord, “paired” Buntings were on their territories (Tener, in Godfrey, 1953).

In the spring of 1955, the largest numbers of Buntings, including *males* as well as females, arrived in late May. Migration culminated on May 30 and 31. Mixed flocks were common then, but these birds were not paired. The largest single flock noted was one of 21 females and seven males. One mixed flock of 18 passed northward, high over Slidre Fiord, at 2.45 p.m. Apparently at lower latitudes the species migrates mostly at night. Tinbergen (1939) noted migrating flocks during the “first three hours after midnight.” Salomonsen (1950–51) also observed night migration.

Despite the constant influx of new males, the authors did not observe the gradual decrease in size of territories as that reported by Tinbergen (1939). This may have been because most of the buntings nested in the rocky interior. The species was fairly abundant at lower elevations in the rough gullies, but the concentrations in the interior were dense by comparison.

Nesting. All observers have found the Snow Bunting in Ellesmere Island in summer. Nestings have been reported from all coasts and parts of the interior. A nest found by Tener (Godfrey, 1953) on the Fosheim Peninsula on June 25, 1951, contained six eggs.

On May 28, 1955, one of the Eureka personnel saw a “snow bird” flying with a grass stem in its bill. This was the first indication of nest building. The first nests, however, were not found until June 17. At that

time some Buntings had not yet commenced laying, while others had already completed their clutches. Nine active nests were found, seven near Slidre Fiord, two far inland. Data concerning these nests are as follows:

Nest No.	Date found	Contents when found	Clutch size	No. young hatched	No. young fledged
1	June 17	eggs 5	7	7	0
2	17	1	6	6	0
3	17	7	7	—	—
4	17	7	8	collected June 19	—
5	17	0	7	collected June 26	—
6	19	1	7	0	0
7	22	6	6	—	—
8	30	7	7	—	—
9	30	5 young*	—	5*	0

*Minimum number

Egg-laying must have started as early as June 11 at Nests 3 and 4. The last young of Nests 1 and 2 hatched July 1 and 5 respectively. Eighteen days elapsed between the laying of the first egg and the hatching of the last young at Nest 2; the period of incubation for the last egg was 12 to 13 days.

Unequal size of embryos in eggs at Nests 4 and 5 and of siblings at Nests 1 and 2 indicates that incubation had started before completion of the clutch. The female of Nest 6 incubated steadily after laying the fourth egg.

Six nests were in shallow niches in sandstone outcrops, two were under loose rocks, and one was 14 inches down in a narrow fissure in soft soil on a bank. All nine were readily accessible. They were composed of dry grasses, leaves, roots, and mosses, thinly lined with Ptarmigan feathers, muskox hair and wool, hare and lemming fur. Nests 3 and 4 were *old nests* lined afresh with grass and feathers. Parts of the old structures were still frozen hard when found. Re-use of old Bunting nests by Buntings has not been reported often (cf. Watson, 1957:104).

A number of old nests were found, some in unusual places. One was between two small hummocks on the open tundra—a long way from rocks or mud mounds. Another, flat against a rock wall on a ledge 3 inches wide, resembled the nest of the Phoebe (*Sayornis phoebe*). In both were bits of shell and feather sheath. Another "exposed" nest was on a ledge of sandstone outcrop that was used as a roost by the Buntings in early spring. It was a nest of the year but not found until September 10. On that date it held one unhatched egg and bits of shell and feather sheath. All of these unusual nestings are suggestive of a dense breeding population.

In 1955 some Buntings may have commenced laying as early as June 4. As stated above, a bird was seen carrying nesting material on May 28. Allowing six days from the start of nest building to the laying of the first egg, as was the case at a Baffin Island nest (Sutton and Parmelee, 1954), one Fosheim Peninsula female probably began laying in early June. This is not entirely speculative. The seeing of a long-tailed young bird on July 15 justifies such a belief. Even at 80° N., the Buntings have time to raise two broods, but the authors found no good evidence that they do so. In

any event the Fosheim Peninsula Buntings in 1955 started nesting no later than did the Buntings in southern Baffin Island in 1953 (Sutton and Parmelee, 1954).

Although nearly all sexual activity ceased in mid-July, males were occasionally seen chasing other males as late as July 21, and a full song was heard as late as August 4.

By July 15 many fledglings had left the nest crevices. Their food calls were loud, and both parents responded to them. Fledged young were fed as late as August 9.

The postnuptial moult in males started by July 15, in females somewhat later, but in late July all adults were moulting heavily. These birds, some attending young, retired to the secluded places back from the fiord coast in August. At times they were almost incapable of flight. Most young birds left the adults in early August and flocked at the fiord slopes. Here they completed the postjuvinal moult by early September. In high-arctic Greenland the moult also takes place rapidly, the new plumage being acquired before early September (Salomonsen, 1950-51).

Departure. Near Slidre Fiord in the autumn of 1953, Bruggemann (1953-54) saw large flocks repeatedly. About 250 birds arrived on September 13 and remained for many days in gradually diminishing numbers. The last was seen on October 8 during a near blizzard. Bruggemann's (1953-54) latest date for 1954: October 11 (one bird).

In 1955 the authors noted something in the nature of premigratory flocking or wandering among the Buntings of the thickly populated interior as early as July 30. Whatever the cause for these movements, many Buntings moved from high ground to low in late July and early August. More and more of them appeared along the fiord coast as the days passed. By mid-September few of them remained in the interior.

Buntings visited Eureka station rarely during the nesting season. When, on August 5, the species did return to the station, most of the birds were full-tailed, unattended juveniles. They visited Eureka early in the morning, often before 4.00 a.m. The large flocks usually dispersed two or three hours later, the birds then temporarily abandoning the fiord shore for the nearby slopes. There they fanned out and fed singly or in small groups. Young birds visiting Eureka early in August were from early broods. One almost in complete winter plumage appeared at Eureka on August 17.

The largest numbers occurred in late August. On August 24 there was a minimum of a thousand Buntings, of all ages at once, about Eureka; there must have been many more on the slopes near by and elsewhere along the fiord. They still visited Eureka during the early mornings, breaking up and dispersing inland during the rest of the day. At times the much rarer Lapland Longspur accompanied them. Some Buntings probably migrated south at this time. Their flights were, however, puzzling. Flocks passed from north to south, high over the fiord; likewise, they passed from south to north as late as August 26. The authors again estimated a thousand Buntings at Eureka on August 27. Then their numbers declined slightly until mid-September, but rapidly thereafter. An immense flock of about 800 Buntings rose from a ridge near Eureka on September 10. The last large flock (about 100 individuals) seen was near Eastwind Lake on September 21. W. Chapman of the U.S. Weather Bureau continued to look

for birds after the authors left Ellesmere Island. He noted six Buntings at Eureka on October 16—the latest record for any bird at Fosheim Peninsula.

The species may winter in limited numbers on the Fosheim Peninsula where seed is always available. Chapman (verbal comm.) said that two Buntings fed on spilled oats at the Alert Station (north coast) within a day or two of November 27, 1952—during the dark period. The station cook saw them several days later, verifying Chapman's observation. When flushed, the Buntings flew off into the darkness beyond the station lights.

Banding. Sixty-two male Snow Buntings were banded at Eureka station from April 28 through May 13, 1955. The birds came readily to toasted whole wheat cereal, and the authors succeeded in catching them by pulling a string attached to a stick supporting a propped-up net. The action was speeded up by attaching the lower edge of the net (stretched over a wire frame) to the spring of a rat trap.

Of the 62 banded, 44 repeated. Noteworthy repeats were: 52-80749, banded April 28, re-caught April 29, April 30, and May 4; 52-80766, banded May 1, re-caught May 10; 52-80790, banded May 4, re-caught May 6 and May 15. No Bunting visited the trap after May 18, and none of the banded birds were seen after May 24, despite the fact that the authors looked closely at hundreds of Buntings during their travels on the peninsula. This is additional evidence that the early arrivals had moved inland in mid-May. It is also indicative of the large numbers of Buntings on the peninsula that year.

Roosting. Little has been stated concerning the roosting habits of the species. The sun was continuously above the horizon when the first male Buntings returned to Fosheim Peninsula in 1955. All of these early birds roosted when the sun was low. At Eureka they slept in a lumber pile—as many as 28 of them together—but away from the station they chose shallow niches in sandstone outcrops. Here, sheltered from the wind, they squatted, sleeping with their bills tucked under their scapulars. Even at -25°F . we did not see them crouched "close together," as is sometimes the case (cf. Salomonsen, 1950-51:542).

The numbers of Buntings at a given roost fluctuated considerably in spring. Birds seen roosting about a single sandstone outcrop numbered from one to 24. Most Buntings roosted in shadowy niches, but some slept in direct sunlight. A single gully often had several roosts.

After territories had been established in the gullies, few Buntings roosted there, but those that did so continued to use the same roosting spots. When flushed from roost, the male Bunting often flew to another roost and alighted beside the defender of another territory. Surprisingly, there was no fighting. Both birds, with heads turned back, went to sleep. If flushed together, there was some show of animosity, some chasing, and even singing until both settled down again, sometimes side by side. This peculiar behaviour was noted only before the females were established on the territories.

New flocks arrived daily and more Buntings than ever inhabited the fiord slopes during the latter part of May. These newly arrived Buntings roosted in eroded snowbanks. Although daily maximum air temperatures

did not reach thawing until May 28, the snow disappeared through evaporation and through heat absorption by embedded grains of wind-blown sand. Whole bank-fronts became deeply pitted, and the pits provided excellent roosting spots. Most of these bank-fronts were accessible to predators, but mammals could not climb them without shattering the ice crystals that formed during the cool hours. The largest number of Buntings seen at a snow roost was 14. Both sexes roosted together.

During May the Fosheim Peninsula Buntings roosted principally between 9.00 p.m. and 2.00 a.m. With the influx of new males and females, and the commencement of courtship, roosting became less regular. More and more Buntings chased about and sang during these hours. By early June, roosting was decidedly irregular, but most Buntings, even then, roosted when the sun was lowest.

During nesting the male roosted within the territory while the female incubated and brooded. Roosting became more regular once courtship was over.

In August, family groups fanned out among the rocks on steep banks when going to roost. These roosting groups became gradually larger. Some flocks roosted among boulders in the nearly dry stream beds, others under huge snowbanks, undercut by running water. The flocks were composed of both sexes and all ages.

In September the sandstone outcrops in the gullies became popular again, but the large flocks roosted on the open tundra where the ground was eroded or hummocky. Some of these flocks contained a hundred or more Buntings. Lapland Longspurs occasionally roosted with them.

The Buntings, as in spring, fed heavily from 6.00 to 8.00 p.m., before retiring. By September, roosting started somewhat earlier, usually between 8.00 and 9.00 p.m. With the coming of night it started still earlier. By late September the buntings roosted as early as 7.30 p.m.

Food. Statements on the arrival of Snow Buntings in low arctic regions often tell of hardships encountered by the birds in search of food. In Greenland the Buntings obtain seed only with great difficulty where snow is deep (Salomonsen, 1950-51); they depend extensively on Eskimo settlements for food in the "thickly snow-covered country" of Angmagssalik (Tinbergen, 1939).

In sharp contrast to low arctic regions, the high-arctic region is virtually a refuge for birds arriving in early spring. On slopes near Slidre Fiord in late April, the authors found Bunting tracks in the thin snow leading from one grass tuft to another. Thorough investigation of the fiord slopes disclosed thousands of such tracks. The scattered grass tufts here provided Buntings and Redpolls with seed throughout the pre-nesting season. Even where the snow had drifted and filled depressions, the Buntings found seed at hare diggings.

The newly arrived Buntings were obviously hungry. Those that came to Eureka fed ravenously and continuously at the Bunting trap for several days—even during those hours when the other Buntings went to roost.

Predation. Not one of the four nests under observation at Fosheim Peninsula in 1955 was successful, but these nests were far from the best breeding places. The hordes of young Buntings seen in the rocky interior was fair proof of a high rate of nesting success in rough country back from

the fiord slopes. Nests placed in fissures or deep crevices among the rocks doubtlessly have better survival value than those placed in mud cracks or shallow niches. The choice of nest site is extremely important to the reproductive success of this species.

Nest 2, situated in a mud crack, was robbed by some predator when the young were small. Nests 1 and 9 were torn to pieces and scattered, as if by a fox. Scattered flight quills of the chicks clearly showed that the broods had been eaten. Although foxes and their tracks were not often noted in the high interior, they did, nevertheless, visit rocky places where Buntings were common. Twenty adult male Buntings together fluttered back and forth, close behind a fox that ran along a ridge where fledgling Buntings were conspicuous (July 14). Foxes were seen stalking adult Buntings unsuccessfully on several occasions, but the tracks of one fox led to a bunting kill (May 17).

Predation at Nest 6 was peculiar. Two of its seven eggs were punctured and empty (when checked July 2), but the other eggs (abandoned), the nest itself, the flat rock above it, and the soft ground about it showed no evidence of having been disturbed. The only plausible explanation is that a lemming fed on two eggs but did not return to eat the others. Lemming tracks were noted near Nest 6 in the autumn. Similar predation has been reported from Baffin Island (Wynne-Edwards, 1952; Sutton and Parmelee, 1954).

The Gyrfalcon caught many Snow Buntings. Fresh and old Bunting remains were at an eyrie in late August. Gyrfalcons are rare near Eureka station in spring and summer, but appear there regularly in the autumn when Buntings are especially abundant. Bruggemann (1953-54) saw a Gyrfalcon chase Buntings there (September 13, 1953), and the Gyrfalcon that the authors shot there (September 9) had recently eaten four Buntings.

The Long-tailed Jaeger was not seen attacking adult Buntings. A small Jaeger chick, however, regurgitated the remains of a Bunting fledgling (July 14).

Specimens. Eight adult males [weight 31.4 to 39.1 gm (av. of seven 36.5), wing chord 104.0 to 111.0 mm (107.3), bill (anterior edge of nasal fossa to tip) 7.5 to 9.0 (8.4)] were collected at Fosheim Peninsula and Axel Heiberg Island (80°42'40"N., 90°59'W.) April 29 to July 23, 1955. Two adult males (weight 44.0 to 45.1, wing chord 109.0 each, bill 7.3 to 8.5) were collected at Fosheim Peninsula, September 15 to 18, 1955. Two immature males (weight 40.1 to 42.7, wing chord 106.0 to 110.0, bill 7.0 to 8.0) were collected at Fosheim Peninsula on August 17 and September 14, 1955 respectively.

Three adult females [weight 31.1 to 37.5 (33.4), wing chord 98.0 to 100.0 (99.0), bill 7.0 to 8.5 (7.8)] and two immature females (weight 41.0 to 44.0, wing chord 103.0 to 104.0, bill 7.2 to 7.8) were collected at Fosheim Peninsula respectively on June 4 to July 16 and September 10 to 15, 1955.

Manning, *et al.* (1956) suggest that the Buntings of Ellesmere Island are shorter billed than those of Baffin Island—a fair hypothesis, but one that should be tested further. Bills of the above 1955 Buntings would appear to be slightly longer than those of the Ellesmere Island (including Fosheim Peninsula) and Baffin Island Buntings that were measured by Manning, *et al.* (but not measured by the authors). The primaries of the

above 1955 Buntings in summer plumage are much worn. Though the sample is small, the autumn specimens probably give a truer measurement of wing chord.

Two Fosheim Peninsula males, although collected in mid-September (1955), clearly show characteristics (see Salomonsen, 1950-51:536) of the nominate race in the October-November plumage.

The primary coverts of Snow Buntings grade from pure white (immaculate) to black-tipped to largely dark to all or nearly dark (Manning, *et al.*, 1956). Salomonsen (1950-51) states that the immaculate and black-tipped condition is "normal" and that the "uniform blackish-brown" covert is a "retarded" condition frequently (but not always) found in first-year birds. Although the authors noted the condition of the coverts when handling Buntings at the Eureka trap in early spring, they did not keep a complete record of the "normal" and "retarded" individuals. Most of the 62 birds handled were of the immaculate or black-tipped type, but some were recorded at the time as having "dark" primary coverts.

The primary coverts of ten adult males collected at Fosheim Peninsula and Axel Heiberg Island in 1955 are: immaculate, two birds (April 29, June 4); black-tipped, five birds (July 4, 23, September 15, 17); largely dark, three birds (July 4, 23). The primary coverts of two immature males collected at Fosheim Peninsula on August 17 and September 14, 1955, are largely dark.

Two sets of eggs [length 22.0 to 23.5 mm (av. of 15 eggs 22.8), width 16.0 to 16.5 (16.2)] were collected at Fosheim Peninsula June 19 to 26, 1955. All 15 eggs are pale bluish white, thinly marked with brown. At one nest the eggs (not collected) were heavily marked, the ground colour being obscured by overlying brown markings.

Annual breeding cycle. Male Snow Buntings arrive at Fosheim Peninsula as early as mid-April. The scattered few gradually become flocks, which feed on the coastal lowlands. Many males move inland in early and mid-May, and territories are established in some areas. The first females then arrive. Flight singing and pairing take place as early as May 21. Late arrivals of both sexes are common near the coast in late May. By June the last flocks disperse, most birds moving into the rocky interior. Nest construction starts as early as May 28 and continues well into June. Nests are placed in crevices in rock or mud, or rarely on rock ledges or on the ground between low hummocks. Old nests are sometimes repaired and used again. Egg-laying probably starts in early June and continues well into late June. The known clutch size for Fosheim Peninsula is six to eight. The female incubates after the laying of the third or fourth egg. The period of incubation is 12 to 13 days. Most young fledge in mid-July. Both sexes feed the nestlings and attend the broods after fledging. Sexual activity declines rapidly in mid-July. The postnuptial moult starts about July 15 in males, somewhat later in females. Juveniles of early broods flock near the fiord coast and moult there. Most adults, some still attending broods, remain inland until the moult is nearly completed. The winter plumage is acquired by September. Young and old swarm over the lowlands in late August and early September, being conspicuous near the fiord coast. Southward migration probably commences in late August. By late September most Buntings have left the peninsula, but a few remain into mid-October, possibly longer.

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PLATE II

A

June 6, 1955. Slidre Fiord. Looking west toward Hare Cape and Axel Heiberg Island (far background). On this day, rivers of slush crept down the dry streambeds and spilled over on the sea-ice. The pools that formed were soon occupied by newly arriving aquatic birds.

B

September 17, 1955. Eureka Weather Station at Slidre Fiord. The old ice is held fast by new ice, which covered the fiord at this date. Sawtooth Range in far background.



A



B

PLATE III

A

July 11, 1955. Incubating Red-throated Loon at a sedgy pond near Iceberg Point. During nesting, adult loons fly to the coast and feed in leads along the shores.

B

July 23, 1955. Young Greater Snow Goose in Axel Heiberg Island Note the sharp contrast in down colour of the dorsal and ventral parts.



A



B

PLATE IV

A

July 11, 1955. Greater Snow Goose nesting habitat south of Iceberg Point. The land here is barren. In the far background, beyond ice-covered Eureka Sound, is Axel Heiberg Island.

B

July 11, 1955. Nest of Greater Snow Goose south of Iceberg Point.



A



B

PLATE V

A

August 23, 1955. Arctic desert south of Slidre Fiord. On the 100-foot sandstone cliffs nested a pair of Gyrfalcons.

B

August 23, 1955. Nesting ledge (protruding rock in foreground) of Gyrfalcons. Below the cliffs the sand is deep and pure and without plants.



A



B

PLATE VI

A

May 31, 1955. Male (left) and female Rock Ptarmigans in changing plumage. Note the several incoming crown feathers of male. The moult is much retarded in males.

B

July 5, 1955. Female Rock Ptarmigan on nest. The moult into summer feather has been completed. The barren clay ground shown here is typical of the slopes rising from Slidre Fiord.



A



B

PLATE VII

A

June 11, 1955. Turnstone nesting habitat near Slidre Fiord. Nest 1 was on snow-free ground near centre of picture. There were two eggs on this date.

B

June 30, 1955. Nest of Turnstone near Eastwind Lake.



A



B

PLATE VIII

A

July 4, 1955. Female Turnstone on nest in well-vegetated tundra near Eastwind Lake.

B

July 14, 1955. Incubating Sanderling in clump of *Dryas* near Eastwind Lake.



A



B

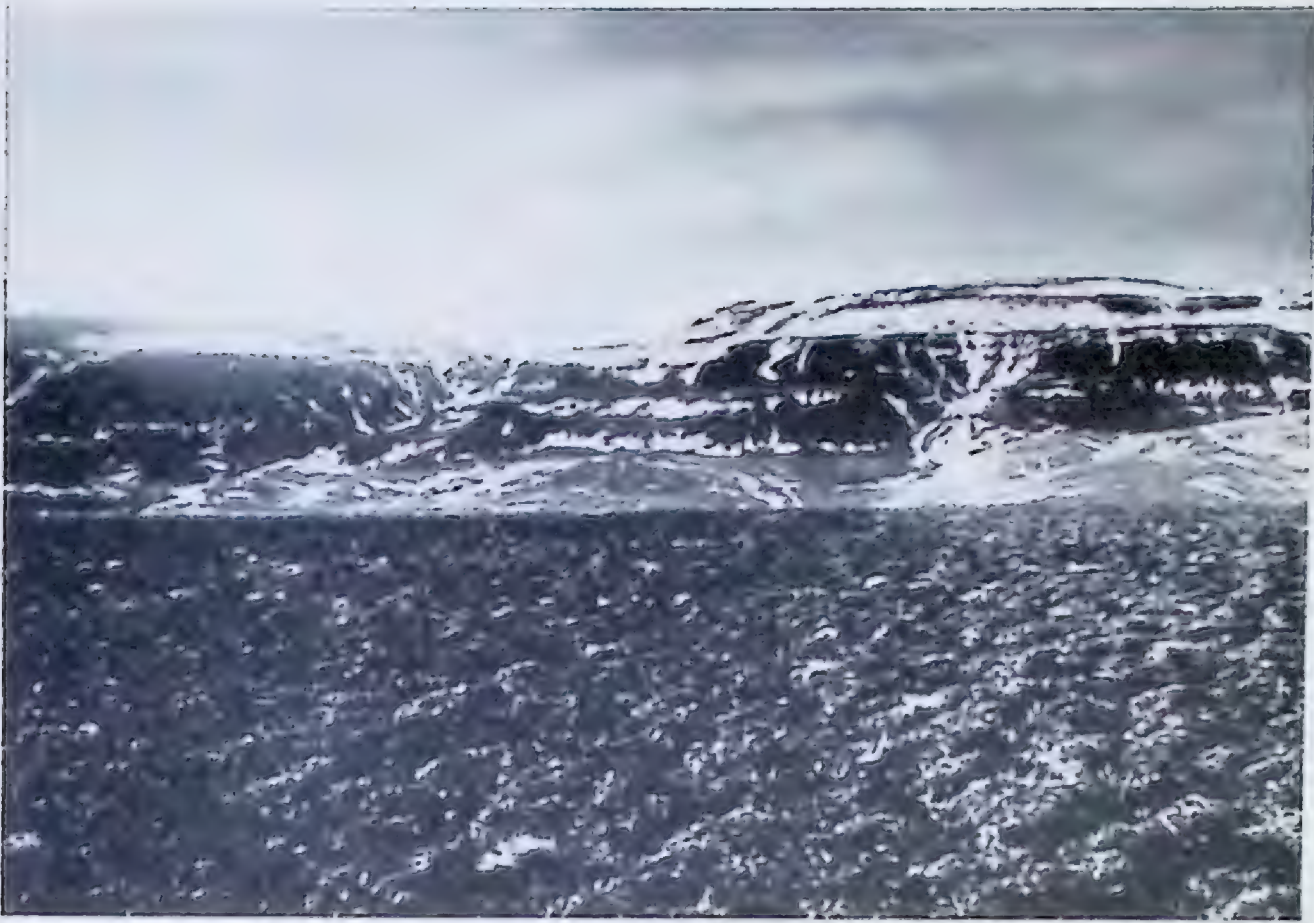
PLATE IX

A

June 21, 1955. Muddy tundra: the nesting habitat of the Knot north of Slidre Fiord. Nest 1 was here. Black Top Ridge in background.

B

June 21, 1955 Nest 1 of the Knot north of Slidre Fiord.



A



B

PLATE X

A

June 14, 1955. Thayer's Gulls at Slidre Fiord.

B

August 3, 1955. Incubating Arctic Tern at Slidre Fiord.



A



B



